ELECTRONIC CODE OF FEDERAL REGULATIONS

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Title 40 → Chapter I → Subchapter D → Part 122 → Subpart B → §122.23

Title 40: Protection of Environment
PART 122—EPA ADMINISTERED PERMIT PROGRAMS: THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
Subpart B—Permit Application and Special NPDES Program Requirements

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§122.23 Concentrated animal feeding operations (applicable to State NPDES programs, see §123.25).

(a) *Scope.* Concentrated animal feeding operations (CAFOs), as defined in paragraph (b) of this section or designated in accordance with paragraph (c) of this section, are point sources, subject to NPDES permitting requirements as provided in this section. Once an animal feeding operation is defined as a CAFO for at least one type of animal, the NPDES requirements for CAFOs apply with respect to all animals in confinement at the operation and all manure, litter, and process wastewater generated by those animals or the production of those animals, regardless of the type of animal.

(b) Definitions applicable to this section:

(1) *Animal feeding operation* ("AFO") means a lot or facility (other than an aquatic animal production facility) where the following conditions are met:

(i) Animals (other than aquatic animals) have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and

(ii) Crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.

(2) *Concentrated animal feeding operation* ("CAFO") means an AFO that is defined as a Large CAFO or as a Medium CAFO by the terms of this paragraph, or that is designated as a CAFO in accordance with paragraph (c) of this section. Two or more AFOs under common ownership are considered to be a single AFO for the purposes of determining the number of animals at an operation, if they adjoin each other or if they use a common area or system for the disposal of wastes.

(3) The term *land application area* means land under the control of an AFO owner or operator, whether it is owned, rented, or leased, to which manure, litter or process wastewater from the production area is or may be applied.

(4) *Large concentrated animal feeding operation* ("Large CAFO"). An AFO is defined as a Large CAFO if it stables or confines as many as or more than the numbers of animals specified in any of the following categories:

(i) 700 mature dairy cows, whether milked or dry;

(ii) 1,000 veal calves;

(iii) 1,000 cattle other than mature dairy cows or veal calves. Cattle includes but is not limited to heifers, steers, bulls and cow/calf pairs;

(iv) 2,500 swine each weighing 55 pounds or more;

(v) 10,000 swine each weighing less than 55 pounds;

(vi) 500 horses;

(vii) 10,000 sheep or lambs;

(viii) 55,000 turkeys;

(ix) 30,000 laying hens or broilers, if the AFO uses a liquid manure handling system;

(x) 125,000 chickens (other than laying hens), if the AFO uses other than a liquid manure handling system;

(xi) 82,000 laying hens, if the AFO uses other than a liquid manure handling system;

(xii) 30,000 ducks (if the AFO uses other than a liquid manure handling system); or

(xiii) 5,000 ducks (if the AFO uses a liquid manure handling system).

(5) The term *manure* is defined to include manure, bedding, compost and raw materials or other materials commingled with manure or set aside for disposal.

(6) *Medium concentrated animal feeding operation* ("Medium CAFO"). The term Medium CAFO includes any AFO with the type and number of animals that fall within any of the ranges listed in paragraph (b)(6)(i) of this section and which has been defined or designated as a CAFO. An AFO is defined as a Medium CAFO if:

(i) The type and number of animals that it stables or confines falls within any of the following ranges:

(A) 200 to 699 mature dairy cows, whether milked or dry;

(B) 300 to 999 veal calves;

(C) 300 to 999 cattle other than mature dairy cows or veal calves. Cattle includes but is not limited to heifers, steers, bulls and cow/calf pairs;

(D) 750 to 2,499 swine each weighing 55 pounds or more;

(E) 3,000 to 9,999 swine each weighing less than 55 pounds;

(F) 150 to 499 horses;

(G) 3,000 to 9,999 sheep or lambs;

(H) 16,500 to 54,999 turkeys;

(I) 9,000 to 29,999 laying hens or broilers, if the AFO uses a liquid manure handling system;

(J) 37,500 to 124,999 chickens (other than laying hens), if the AFO uses other than a liquid manure handling system;

(K) 25,000 to 81,999 laying hens, if the AFO uses other than a liquid manure handling system;

(L) 10,000 to 29,999 ducks (if the AFO uses other than a liquid manure handling system); or

(M) 1,500 to 4,999 ducks (if the AFO uses a liquid manure handling system); and

(ii) Either one of the following conditions are met:

(A) Pollutants are discharged into waters of the United States through a man-made ditch, flushing system, or other similar man-made device; or

(B) Pollutants are discharged directly into waters of the United States which originate outside of and pass over, across, or through the facility or otherwise come into direct contact with the animals confined in the operation.

(7) *Process wastewater* means water directly or indirectly used in the operation of the AFO for any or all of the following: spillage or overflow from animal or poultry watering systems; washing, cleaning, or flushing pens, barns, manure pits, or other AFO facilities; direct contact swimming, washing, or spray cooling of animals; or dust control. Process wastewater also includes any water which comes into contact with any raw materials, products, or byproducts including manure, litter, feed, milk, eggs or bedding.

(8) *Production area* means that part of an AFO that includes the animal confinement area, the manure storage area, the raw materials storage area, and the waste containment areas. The animal confinement area includes but is not limited to open lots, housed lots, feedlots, confinement houses, stall barns, free stall barns, milkrooms, milking centers, cowyards, barnyards, medication pens, walkers, animal walkways, and stables. The manure storage area includes but is not limited to lagoons, runoff ponds, storage sheds, stockpiles, under house or pit storages, liquid impoundments, static piles, and composting piles. The raw materials storage area includes but is not limited to feed silos, silage bunkers, and bedding materials. The waste containment area includes but is not limited to settling basins, and areas within berms and diversions which separate uncontaminated storm water. Also included in the definition of production area is any egg washing or egg processing facility, and any area used in the storage, handling, treatment, or disposal of mortalities.

(9) *Small concentrated animal feeding operation* ("Small CAFO"). An AFO that is designated as a CAFO and is not a Medium CAFO.

(c) *How may an AFO be designated as a CAFO?* The appropriate authority (*i.e.*, State Director or Regional Administrator, or both, as specified in paragraph (c)(1) of this section) may designate any AFO as a CAFO upon determining that it is a significant contributor of pollutants to waters of the United States.

(1) *Who may designate?*—(i) *Approved States.* In States that are approved or authorized by EPA under Part 123, CAFO designations may be made by the State Director. The Regional Administrator may also designate CAFOs in approved States, but only where the Regional Administrator has determined that one or more pollutants in the AFO's discharge contributes to an impairment in a downstream or adjacent State or Indian country water that is impaired for that pollutant.

(ii) *States with no approved program.* The Regional Administrator may designate CAFOs in States that do not have an approved program and in Indian country where no entity has expressly demonstrated authority and has been expressly authorized by EPA to implement the NPDES program.

(2) In making this designation, the State Director or the Regional Administrator shall consider the following factors:

(i) The size of the AFO and the amount of wastes reaching waters of the United States;

(ii) The location of the AFO relative to waters of the United States;

(iii) The means of conveyance of animal wastes and process waste waters into waters of the United States;

(iv) The slope, vegetation, rainfall, and other factors affecting the likelihood or frequency of discharge of animal wastes manure and process waste waters into waters of the United States; and

(v) Other relevant factors.

(3) No AFO shall be designated under this paragraph unless the State Director or the Regional Administrator has conducted an on-site inspection of the operation and determined that the operation should and could be regulated under the permit program. In addition, no AFO with numbers of animals below those established in paragraph (b)(6) of this section may be designated as a CAFO unless:

(i) Pollutants are discharged into waters of the United States through a manmade ditch, flushing system, or other similar manmade device; or

(ii) Pollutants are discharged directly into waters of the United States which originate outside of the facility and pass over, across, or through the facility or otherwise come into direct contact with the animals confined in the operation.

(d) *NPDES permit authorization*—(1) *Permit Requirement.* A CAFO must not discharge unless the discharge is authorized by an NPDES permit. In order to obtain authorization under an NPDES permit, the CAFO owner or operator must either apply for an individual NPDES permit or submit a notice of intent for coverage under an NPDES general permit.

(2) *Information to submit with permit application or notice of intent.* An application for an individual permit must include the information specified in §122.21. A notice of intent for a general permit must include the information specified in §§122.21 and 122.28.

(3) *Information to submit with permit application.* A permit application for an individual permit must include the information specified in §122.21. A notice of intent for a general permit must include the information specified in §§122.21 and 122.28.

(e) *Land application discharges from a CAFO are subject to NPDES requirements.* The discharge of manure, litter or process wastewater to waters of the United States from a CAFO as a result of the application of that manure, litter or process wastewater by the CAFO to land areas under its control is a discharge from that CAFO subject to NPDES permit requirements, except where it is an agricultural storm water discharge as provided in 33 U.S.C. 1362(14). For purposes of this paragraph, where the manure, litter or process wastewater has been applied in accordance with site specific nutrient management practices that ensure appropriate agricultural utilization of the nutrients in the manure, litter or process wastewater, as specified in §122.42(e)(1)(vi)-(ix), a precipitation-related discharge of manure, litter or process wastewater from land areas under the control of a CAFO is an agricultural stormwater discharge.

(1) For unpermitted Large CAFOs, a precipitation-related discharge of manure, litter, or process wastewater from land areas under the control of a CAFO shall be considered an agricultural stormwater discharge only where the manure, litter, or process wastewater has been land applied in accordance with site-specific nutrient management practices that ensure appropriate agricultural utilization of the nutrients in the manure, litter, or process wastewater, as specified in §122.42(e)(1)(vi) through (ix).

(2) Unpermitted Large CAFOs must maintain documentation specified in §122.42(e)(1)(ix) either on site or at a nearby office, or otherwise make such documentation readily available to the Director or Regional Administrator upon request.

(f) *By when must the owner or operator of a CAFO have an NPDES permit if it discharges?* A CAFO must be covered by a permit at the time that it discharges.

(g) [Reserved]

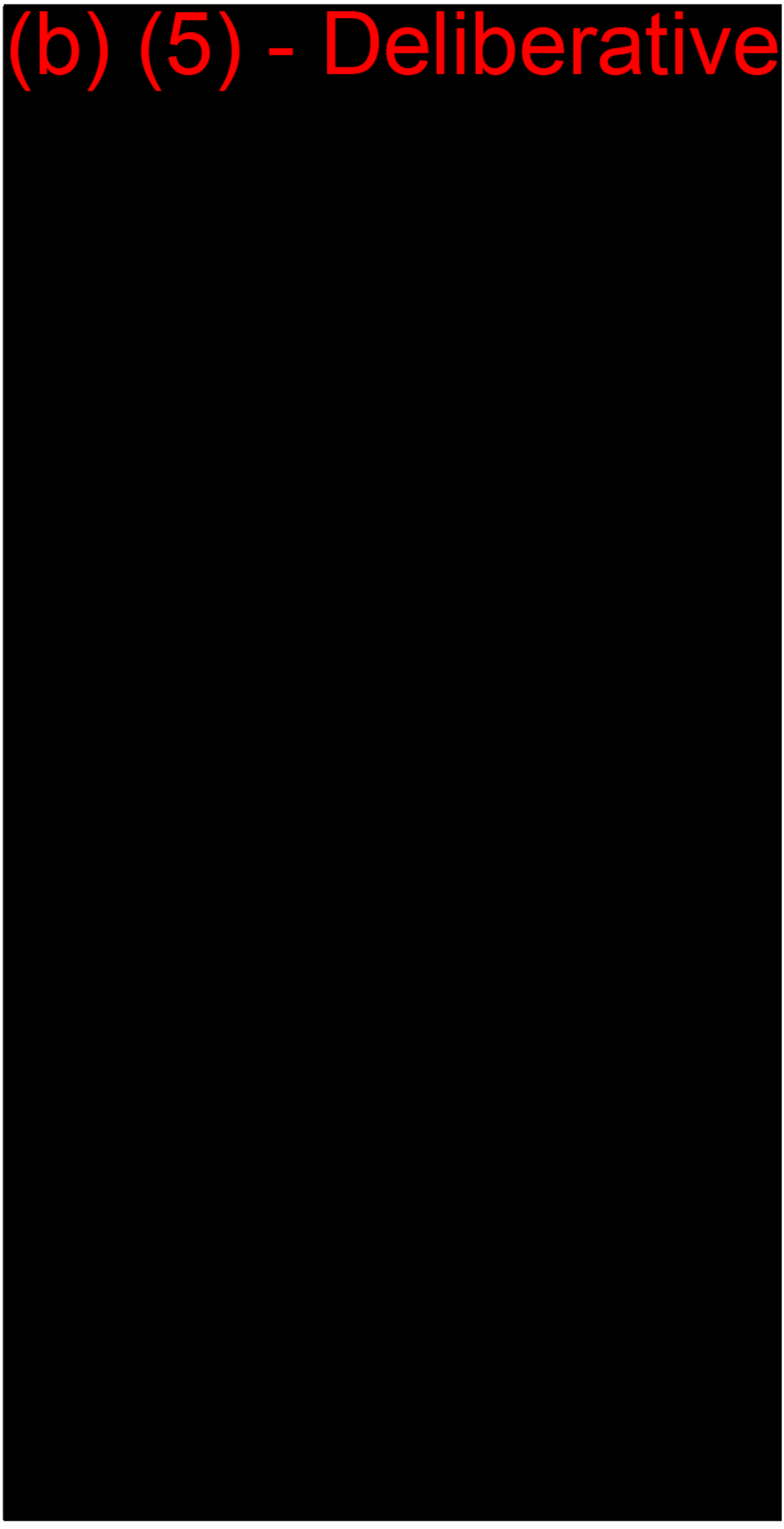
(h) *Procedures for CAFOs seeking coverage under a general permit.* (1) CAFO owners or operators must submit a notice of intent when seeking authorization to discharge under a general permit in accordance with §122.28(b). The Director must review notices of intent submitted by CAFO owners or operators to ensure that the notice of intent includes the information required by §122.21(i)(1), including a nutrient management plan that meets the requirements of §122.42(e) and applicable

effluent limitations and standards, including those specified in 40 CFR part 412. When additional information is necessary to complete the notice of intent or clarify, modify, or supplement previously submitted material, the Director may request such information from the owner or operator. If the Director makes a preliminary determination that the notice of intent meets the requirements of §§122.21(i)(1) and 122.42(e), the Director must notify the public of the Director's proposal to grant coverage under the permit to the CAFO and make available for public review and comment the notice of intent submitted by the CAFO, including the CAFO's nutrient management plan, and the draft terms of the nutrient management plan to be incorporated into the permit. The process for submitting public comments and hearing requests, and the hearing process if a request for a hearing is granted, must follow the procedures applicable to draft permits set forth in 40 CFR 124.11 through 124.13. The Director may establish, either by regulation or in the general permit, an appropriate period of time for the public to comment and request a hearing that differs from the time period specified in 40 CFR 124.10. The Director must respond to significant comments received during the comment period, as provided in 40 CFR 124.17, and, if necessary, require the CAFO owner or operator to revise the nutrient management plan in order to be granted permit coverage. When the Director authorizes coverage for the CAFO owner or operator under the general permit, the terms of the nutrient management plan shall become incorporated as terms and conditions of the permit for the CAFO. The Director shall notify the CAFO owner or operator and inform the public that coverage has been authorized and of the terms of the nutrient management plan incorporated as terms and conditions of the permit applicable to the CAFO.

(2) *For EPA-issued permits only.* The Regional Administrator shall notify each person who has submitted written comments on the proposal to grant coverage and the draft terms of the nutrient management plan or requested notice of the final permit decision. Such notification shall include notice that coverage has been authorized and of the terms of the nutrient management plan incorporated as terms and conditions of the permit applicable to the CAFO.

(3) Nothing in this paragraph (h) shall affect the authority of the Director to require an individual permit under §122.28(b)(3).

[68 FR 7265, Feb. 12, 2003, as amended at 71 FR 6984, Feb. 10, 2006; 72 FR 40250, July 24, 2007; 73 FR 70480, Nov. 20, 2008; 77 FR 44497, July 30, 2012]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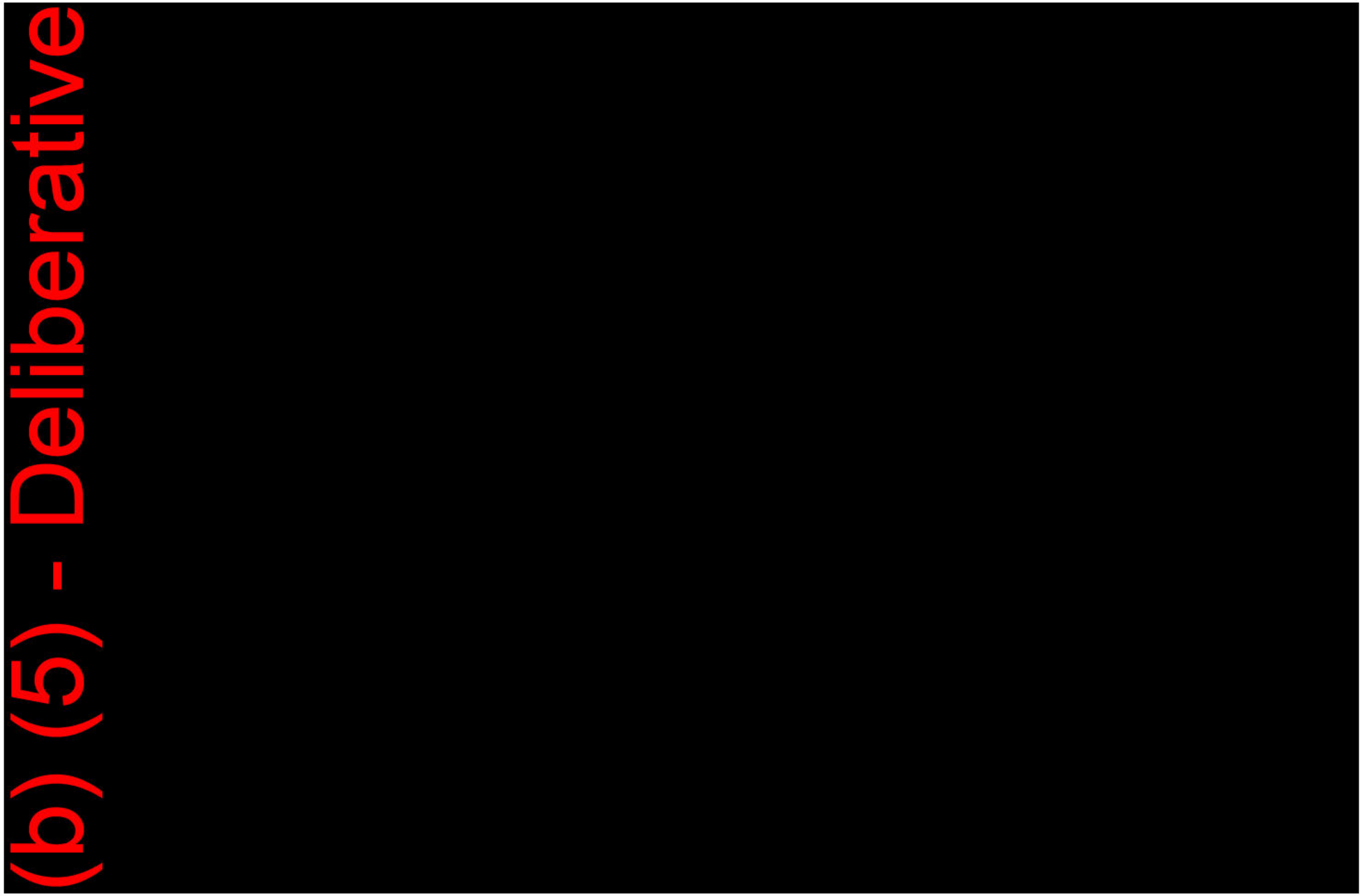
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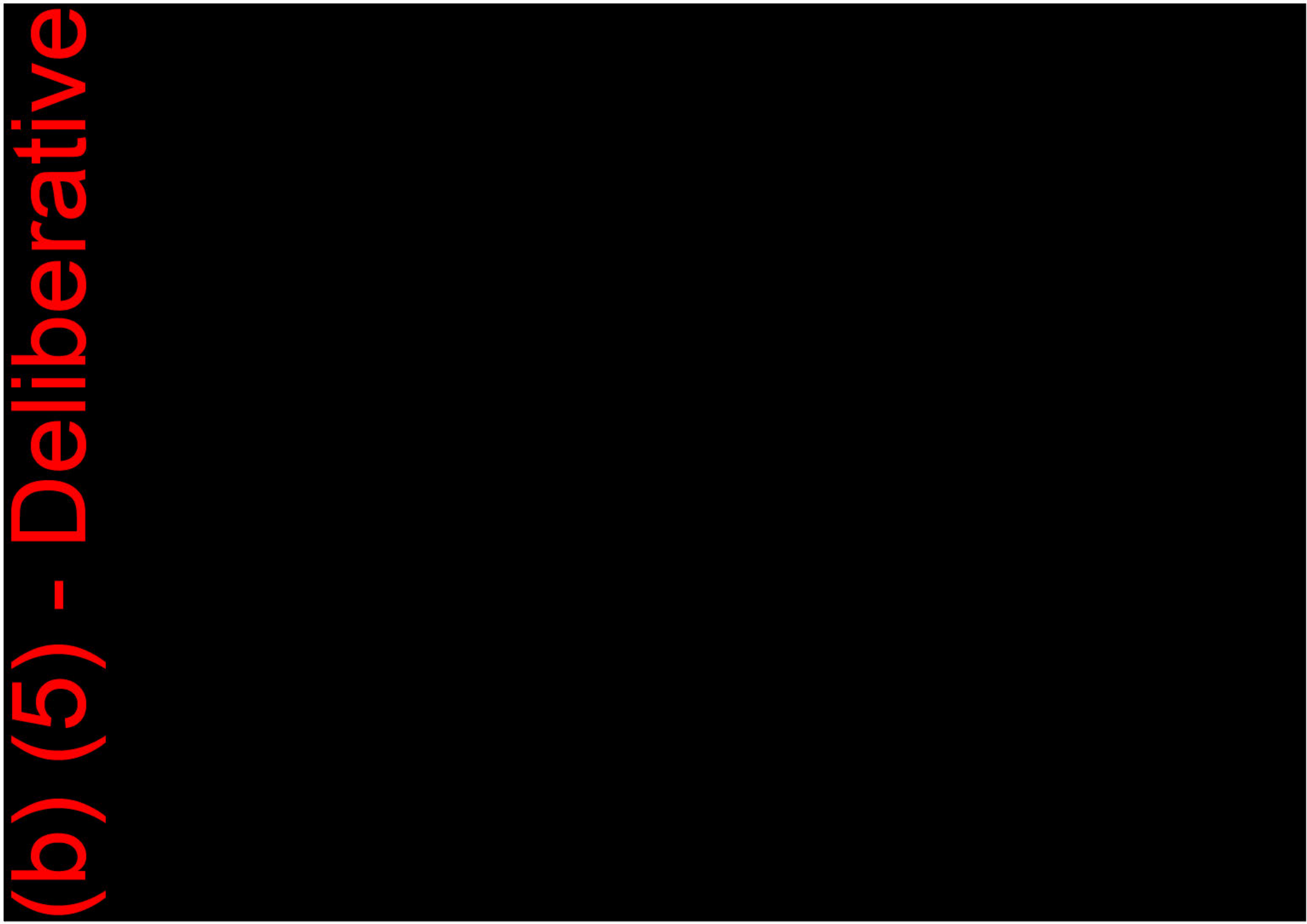
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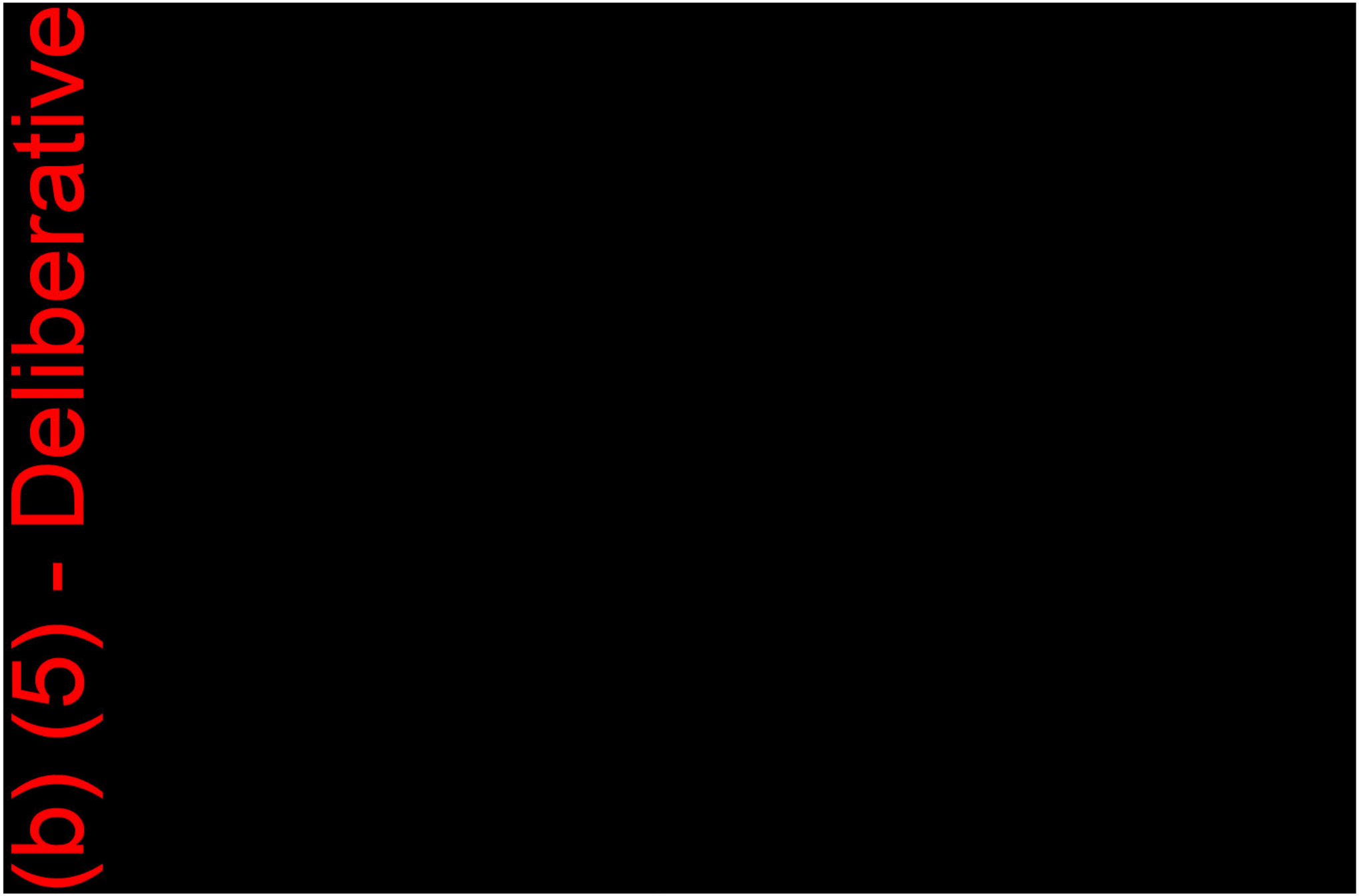
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(b) (5) - Deliberative

EARTHJUSTICE

ALASKA CALIFORNIA FLORIDA MID-PACIFIC NORTHEAST NORTHERN ROCKIES
NORTHWEST ROCKY MOUNTAIN WASHINGTON, D.C. INTERNATIONAL

September 3, 2014

By email and Federal Express

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Dear Ms. McCarthy and Ms. Golightly-Howell:

Re: Complaint Under Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d, 40 C.F.R. Part 7

The North Carolina Environmental Justice Network, Rural Empowerment Association for Community Help ("REACH"), and Waterkeeper Alliance, Inc. ("Complainants") submit this complaint against the North Carolina Department of Environment and Natural Resources ("DENR") for issuing a general permit that allows industrial swine facilities in North Carolina to operate with grossly inadequate and outdated systems of controlling animal waste and little provision for government oversight, which has an unjustified disproportionate impact on the basis of race and national origin against African Americans, Latinos and Native Americans in violation of Title VI of the Civil Rights Act of 1964, 42 U.S.C. §§ 2000d to 2000d-7, and the United States Environmental Protection Agency's ("EPA") implementing regulations, 40 C.F.R. Part 7.

DENR currently allows more than 2,000 swine operations—with the collective capacity to raise more than 9.5 million swine in confinement—to operate within the state and,

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particularly, in the coastal plain in the eastern portion of the state.[1] The permitted swine facilities generate a staggering amount of waste that wreaks havoc on the health and well-being of neighboring communities and the environment. Under the permit, these facilities can continue to store urine and feces in open-air cesspools, called lagoons, before spraying the waste on fields with high volume spreaders. At all steps of this so-called waste management system, waste from the facilities can pollute the air and water and injure human health.

For years, Complainants and other community members in eastern North Carolina have complained to DENR about the adverse effects of the swine industry on their health and environment and have implored the agency to provide greater protection. The eastern portion of the state contains counties that have more industrial swine facilities, and are more densely populated by swine, than anywhere else in the country.[2] Study after study has documented that the swine industry pollutes the air and water, interferes with the enjoyment of property, causes property values to plummet, and takes a toll on human health. Despite the research, and repeated requests that the agency revise the permit program to protect communities, in March of this year, DENR failed to conduct an analysis of the potential disproportionate impact of the permit and issued a permit with essentially the same conditions as previous permits, conditions that proved woefully inadequate to protect the health and environment of the affected communities. DENR did not require facilities to do away with the polluting lagoon and sprayfield system, or to make modifications that would prevent waste from escaping from the confinement houses, the high volume sprayers, the lagoons, the waste application fields, or any other of the many conduits for pollution. DENR also failed to impose rigorous government inspection and oversight to ensure that the swine facilities meet the meager protections in the permit, and to monitor the ways in which the facilities affect the environment and human health.

(b) (5) Deliberative

The effects of the swine industry on the health and environment of communities in eastern North Carolina are all the worse given the growth of the poultry industry in this region, and the cumulative impact of swine and poultry waste. More must be done to protect these communities, yet at the same time, the state has cut the number of inspectors at DENR, limiting the agency's ability to enforce even existing permit terms.

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[1] The current general permit expires on September 30, 2014. At the time this complaint was written, DENR had not published notice of the facilities that are covered under the revised permit, but, as described in footnote 26, *infra*, the number of permitted facilities is not expected to change. Complainants will supplement this complaint when DENR makes available a new list of covered facilities.

[2] *See* Feedstuffs, Hog Density by County (May 24, 2010), *available at* http://fdsmagissues.feedstuffs.com/fds/PastIssues/FDS8221/fds14_8221.pdf and http://fdsmagissues.feedstuffs.com/fds/PastIssues/FDS8221/fds15_8221.pdf (showing that ten counties in eastern North Carolina have the highest density of swine of all counties in the country).

Complainants believe that but for the race and national origin of the impacted population, which is disproportionately African American, Latino, and Native American, DENR would be more responsive to the crying need for stronger permit conditions. Given the high burden required to prove claims of intentional discrimination, however, Complainants do not at this time allege that DENR intentionally discriminated against communities of color in issuing the general permit. Nonetheless, this complaint should be understood in the context of a dynamic where race and ethnicity continue to play a role in governance and DENR's failure to be responsive to the need for improvement in waste management at industrial swine facilities. North Carolina is the birthplace of the environmental justice movement. It is in North Carolina that, in the early 1980s, DENR designated a predominantly African American community to receive soil contaminated with polychlorinated biphenyls ("PCBs"), leading to the formation of the Warren County Citizens Concerned about PCBs. This group turned to acts of civil disobedience to have their voices heard.

Since the early 1990s, African American, Latino, and Native American community members have sought greater protection from the adverse impacts of industrial swine production, but time and again their requests have been unanswered. Complainants hope that in the year 2014, the Office of Civil Rights will enforce Title VI of the Civil Rights Act of 1964 and EPA's implementing regulations, and will respond with the full force of law—withdrawing DENR's funding, if need be—to protect communities of color from the injustice of being forced to live and work near inadequately regulated industrial pollution sources. Complainants request that EPA investigate the complaint and, upon finding discrimination, require that DENR conduct a disproportionate impact analysis and come into compliance with the law by overhauling the general permit to protect African Americans, Latinos, and Native Americans from the adverse disproportionate impacts of industrial swine facilities.

I. NATURE OF THE ACTION

(b) (5) Deliberative [redacted]

1. This is a complaint for relief under Title VI of the Civil Rights Act of 1964, 42 U.S.C. §§ 2000d to 2000d-7, and the United States Environmental Protection Agency's ("EPA") implementing regulations, 40 C.F.R. Part 7, arising from DENR's decision to issue a permit that allows industrial swine facilities in North Carolina to operate with inadequate and outdated systems of controlling animal waste and little oversight to the detriment of neighboring African American, Latino, and Native American communities.

2. On March 7, 2014, DENR finalized a renewal of the Swine Waste Management System General Permit, AWG100000 (the "General Permit"). The General Permit should protect communities that live and work near the permitted swine facilities from the staggering amounts of waste that the facilities generate; it sets forth the standards that more than 2,000 industrial swine facilities in North Carolina must meet to operate legally within North Carolina. However, the General Permit falls far short of what is needed to protect human health and the environment. Permitted industrial swine facilities are allowed to store animal waste in open-air

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pits, called lagoons, that can spill waste into surface waters and leach harmful pollutants into groundwater that feeds drinking water sources, and to spray that waste on fields with high volume spreaders that spew pollutants not only onto the fields, but also into nearby communities. Wastewater from the sprayfields can seep into groundwater or run off into nearby surface waters. The General Permit does not require rigorous government oversight, monitoring, and reporting that would allow the state and the public to understand the full extent to which pollutants from the facilities are getting into the air and water and making people sick.

3. Surface waters in North Carolina are polluted with waste from permitted swine facilities. Communities have lost streams and ponds that they had relied on for fishing and swimming to the runoff and water pollution that comes with the industrial swine industry. After catching fish with open sores and infections, people have had to abandon favorite fishing holes, losing not only a source of recreation but also a way of feeding their families.

4. Pollutants, including nitrates, phosphorus, bacteria, viruses, and parasites can leach from the earthen lagoons that are authorized under the permit into the groundwater. Polluted groundwater, in turn, can feed drinking water sources, including wells. Fearing that their well water is contaminated, people living near permitted industrial swine facilities have been forced to connect to municipal water supplies at personal expense.

5. Air pollution from the permitted swine facilities is a significant problem for human health and welfare. Gases, including ammonia, hydrogen sulfide, volatile organic compounds ("VOCs"), particles from feces, dander, feed, and dead microorganisms, and live bacteria and viruses are emitted from the confinement houses through mechanical ventilation or massive industrial fans. The lagoons and the sprayers that distribute the waste on to the fields also emit gasses into the air. Because of the terrible smell and harmful pollutants, people living near permitted industrial swine facilities experience difficulty breathing when the facilities are spraying. They suffer from asthma attacks, runny noses and eyes, and bronchitis. They have trouble sleeping. They avoid going outside and keep windows closed lest they be inundated with the overpowering smell of the waste and the flies that the waste attracts. Many community members no longer hang their clothes on the line to dry for fear that the clothes will be coated with manure.

6. The permitted swine facilities are located disproportionately in African American, Latino, and Native American communities, and African Americans, Latinos and Native Americans disproportionately bear the burden of the General Permit's failure to control the waste at the permitted swine facilities.

7. Title VI of the Civil Rights Act of 1964, and EPA's regulations, prohibit recipients of federal financial assistance, such as DENR, from taking action that disproportionately burdens persons on the basis of race. DENR's decision to reissue the General Permit without measures to protect African Americans, Latinos, and Native Americans living and working near

the swine facilities from the staggering amounts of pollution the permitted swine facilities generate violates the basic civil rights protections set forth in Title VI.[3]

II. PARTIES

8. Complainant North Carolina Environmental Justice Network ("Environmental Justice Network") is a statewide, grassroots-led organization made up of community members and other organizations that are working to fight environmental injustice. The Environmental Justice Network seeks to promote health and environmental equality for all people in North Carolina through organizing, advocacy, research, and education based on principles of economic equity and democracy for all. The Environmental Justice Network supports the communities that are most impacted by environmental injustice and has worked for over a decade to change the fact that industrial swine facilities in North Carolina are allowed to pollute low-income and African American communities. Declaration of (b) (6), (b) (7)(C) ¶¶ 4-5, 13-48, attached as Exhibit 30 [(b) (6), (b) (7)(C) Decl.].

9. Complainant Rural Empowerment Association for Community Help ("REACH") is an organization that seeks to address social, economic, and environmental inequities in Duplin, Sampson, and Bladen Counties. Through research and advocacy, REACH has worked to change the system that allows industrial swine facilities to pollute the environment and to destroy the health and welfare of the affected communities. Declaration of (b) (6), (b) (7)(C) ¶¶ 4-13, attached as Exhibit 16 [(b) (6) Decl.].

10. Complainant Waterkeeper Alliance, Inc. is a nonprofit organization that unites the more than 200 Waterkeeper organizations that patrol and protect the waterways in North Carolina, across the United States, and around the world. Waterkeeper Alliance's Pure Farms, Pure Waters Campaign recognizes that concentrated animal feeding operations, including swine facilities, and the rise of corporate controlled meat production have nearly destroyed the family farm and severely poisoned the nation's waters. As part of the Pure Farms, Pure Waters Campaign, Waterkeeper Alliance has worked with communities in eastern North Carolina to stop industrial swine facilities from destroying the waters and human health. Declaration of (b) (6), (b) (7)(C) ¶¶ 12-14, attached as Exhibit 6 [(b) (6), (b) (7)(C) Decl.].

11. DENR is an agency of the State of North Carolina. N.C. Gen. Stat. § 143B-279.1. DENR is charged with protecting North Carolina's environment and public health, *id.* § 143B-279.2, and has the power to issue permits to carry out this mission. *Id.* § 143-215.1(a)-(b). The Environmental Management Commission ("EMC") of DENR, *id.* § 143B-282(a)(1)(a), has the authority to regulate animal waste management systems at swine facilities. *Id.* § 143-

[3] This is not a siting case. Stated simply, DENR's decision to issue a permit that fails to control pollution from the permitted swine facilities has an unjustified disproportionate impact on African American, Latino, and Native Americans in violation of Title VI and its regulations.

215.1(a)(12) (requiring animal waste management systems to obtain a permit from the EMC of DENR); *id.* § 143-212(2).

III. JURISDICTION

A. DENR Is Subject to Title VI

12. Title VI of the Civil Rights Act of 1964 prohibits recipients of federal funds from discriminating against individuals on the basis of race, color, or national origin.

13. Title VI provides that "[n]o person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." 42 U.S.C. § 2000d.

14. Acceptance of federal funds, including EPA assistance, creates an obligation on the recipient to comply with Title VI and EPA's implementing regulations.

15. EPA's Title VI regulations provide that "[n]o person shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving EPA assistance on the basis of race, color [or] national origin." 40 C.F.R. § 7.30.

16. EPA's regulations provide the following specific prohibitions, at 40 C.F.R. § 7.35:

> (a) As to any program or activity receiving EPA assistance, a recipient shall not directly or through contractual, licensing, or other arrangements on the basis of race, color, [or] national origin . . . :
>
> > (1) Deny a person any service, aid or other benefit of the program or activity;
> >
> > (2) Provide a person any service, aid or other benefit that is different, or is provided differently from that provided to others under the program or activity;
> >
> > . . .
>
> (b) A recipient shall not use criteria or methods of administering its program or activity which have the effect of subjecting individuals to discrimination because of their race, color, [or] national origin, . . . or have the effect of defeating or substantially impairing accomplishment of the objectives of the program or activity with respect to individuals of a particular race, color, [or] national origin . . . .
>
> . . .

(d) This list of the specific prohibitions of discrimination do not limit the general prohibition of § 7.30.

i. DENR is a Program or Activity Covered by Title VI

17. DENR is a program or activity covered by Title VI. Title VI defines program or activity as "all of the operations of . . . a department, agency, special purpose district, or other instrumentality of a State or of a local government . . . ***any part of which*** is extended Federal financial assistance." 42 U.S.C. § 2000d-4a (emphasis added).

18. Under Title VI, if any part of a listed entity receives federal funds, the whole entity is covered by Title VI. *Ass'n of Mex.-Am. Educ. v. California*, 195 F.3d 465, 474-75 (9th Cir. 1999, *rev'd in part on other grounds*, 231 F.3d 572 (9th Cir. 2000) (en banc).

19. DENR is an agency of the state of North Carolina that, as shown in paragraphs 20 to 26 below, receives federal financial assistance from EPA. DENR, thus meets the definition of program or activity under Title VI and must comply with Title VI in implementing all of its programs, whether or not the particular portion of the program or activity itself specifically received EPA funding.

ii. DENR is a Recipient of EPA Assistance

20. EPA's Title VI regulations define a "[r]ecipient" as "any state or its political subdivision, any instrumentality of a state or its political subdivision, any public or private agency, institution, organization, or other entity, or any person to which Federal financial assistance is extended directly or through another recipient . . . ." 40 C.F.R. § 7.25.

21. EPA's regulations define "EPA assistance" to mean "any grant or corporative agreement, loan, contract . . . , or any other arrangement by which EPA provides or otherwise makes available assistance in the form of funds," among other means. 40 C.F.R. § 7.25.

22. DENR was a recipient of EPA assistance as of March 7, 2014, the time of the alleged discriminatory action, as shown in Exhibit 1.A (EPA award of federal funds to DENR in fiscal year 2014) and Exhibit 1.B (EPA awards of federal funds to DENR extending into fiscal year 2014 and thereafter).

23. USASpending.gov is a searchable website operated by the Office of Management and Budget, which provides the public with information about federal awards, including the name of the entity receiving the award and the amount of the award.

24. According to USASpending.gov, as of August 27, 2014, EPA had awarded DENR at least $19,282,355 in federal funds for fiscal year 2014.[4] Of this amount, $14,899,454 was given as continuations of awards given in previous fiscal years, and $4,382,901 was given to fund new projects. For example, $4,340,904 was earmarked for "Water Pollution Control State, Interstate, and Tribal Program Support," a program that received more than $7 million across five of the disbursements in fiscal year 2014. In fiscal year 2014, EPA also earmarked $3.1 million for "State Public Water System Supervision," $2.2 million for "Hazardous Waste Management State Program Support," and $2.2 million for "Leaking Underground Storage Tank Trust Fund Corrective Action Program."[5] *See* Exhibit 1.A (EPA award of federal funds to DENR in fiscal year 2014) (compiling awards for fiscal year 2014).

25. As of August 27, 2014, 22 of DENR's programs had received or were receiving EPA assistance for programs that extended into 2014 and beyond.[6] *See* Exhibit 1.B (EPA awards of federal funds to DENR extending into fiscal year 2014 and thereafter).

26. Because DENR is a department of the State of North Carolina that receives EPA grants and funding, DENR is subject to Title VI.

B. **The Complaint is Timely**

27. DENR issued the General Permit on March 7, 2014. This complaint is timely as it is filed within 180 days of the discriminatory action, DENR's approval of the General Permit. 40 C.F.R. § 7.120(b)(2).[7]

C. **The Complaint Meets Other Jurisdictional Criteria**

28. This complaint meets all other jurisdictional criteria: it is in writing; it identifies DENR as the entity that allegedly performed the discriminatory act and describes the acts that violate EPA's Title VI regulations; and, should EPA so require, it is also filed by groups that are

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[4] Fiscal year 2014 began on October 1, 2013 and ends on September 30, 2014.

[5] USA Spending, http://www.usaspending.gov (enter "809785280" then select "Environmental Protection Agency" under "By Agency" and "2014" under "By Fiscal Year").

[6] This data reflects only that which is available on usaspending.gov. It is possible that data from some awards made by EPA to DENR were omitted from the data on usaspending.gov, and thus are not included in Exhibits 1.A and 1.B.

[7] In addition, OCR has authority to waive the time limit for good cause, 40 C.F.R. § 7.120(b)(2), and has affirmative authority to conduct post-award compliance reviews when it has "reason to believe that discrimination may be occurring." *Id.* § 7.115(a).

authorized to represent people who were discriminated against in violation of EPA's Title VI regulations.[8]

IV. FACTUAL BACKGROUND

A. The Industrial Swine Industry and the Development of the State Permitting Program

29. The North Carolina swine industry has "changed dramatically since the 1980's from the small farm raising a few hogs to large confinement type operations."[9] In 1982, more than 11,000 swine farms raised approximately 2 million animals.[10] By 1997, the number of farms had dropped to fewer than 3,000, while the swine population had ballooned to nearly 10 million.[11]

30. In 1995, a disaster at a swine lagoon brought the growing industry into the public eye. In the summer of 1995, a lagoon at a swine facility in Jacksonville, North Carolina burst, spilling 28.5 million gallons of swine waste into a tributary to the New River.[12]

31. The spill focused attention on the swine industry, and its significant potential to threaten human health and welfare. Following the spill, in 1995, the North Carolina General Assembly created the Blue Ribbon Study Commission on Agricultural Waste to study "[t]he

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[8] *See* EPA, Draft Revised Guidance for Investigating Title VI Administrative Complaints Challenging Permits (Draft Revised Investigations Guidance), 65 Fed. Reg. 39,667, 39,672 (June 27, 2000) (listing jurisdictional criteria applicable to Title VI complaints).

[9] N.C. Dep't of Agric. & Consumer Servs., Agricultural Overview – Commodities, http://www.ncagr.gov/stats/general/commodities.htm (last visited Aug. 28, 2014); *see also* Chris Hurt & Kelly Zering, *Hog Production Booms in North Carolina: Why There? Why Now?*, *in* Dep't of Agric. Econ., Purdue Univ., Purdue Agric. Econ. Report 11 (1993), *available at* http://www.agecon.purdue.edu/extension/pubs/paer/pre_98/paer0893.pdf; Pew Commission on Industrial Farm Animal Production, Putting Meat on the Table: Industrial Farm Animal Production in America (2008), *available at* http://www.ncifap.org/_images/PCIFAPSmry.pdf, attached as Exhibit 46 [hereinafter, Pew, Putting Meat on the Table] (describing the rise of industrial animal production in America and the effects on public health and the environment); Pew Commission on Industrial Farm Animal Production, Environmental Impact of Industrial Farm Animal Production 1-2 (2008), *available at* http://www.ncifap.org/_images/212-4_EnvImpact_tc_Final.pdf, attached as Exhibit 45 [hereinafter, Pew, Environmental Impact] (same).

[10] U.S. Dep't of Agric., Census of Agriculture 30 tbl. 32 (1987), *available at* http://usda.mannlib.cornell.edu/usda/AgCensusImages/1987/01/33/3/Table-32.pdf.

[11] U.S. Dep't of Agric. 1997 Census of Agriculture – Highlights of Agriculture: 1997 and 1992 North Carolina, http://www.agcensus.usda.gov/Publications/1997/Census_Highlights/North_Carolina/ncst.txt (last visited Aug. 28, 2014).

[12] JoAnn M. Burkholder et al., *Impacts to a Coastal River and Estuary from Rupture of a Large Swine Waste Holding Lagoon*, 26 J. Envtl. Qual. 1451, 1452-53 (1997), attached as Exhibit 2 to Exhibit 14, Declaration of [redacted] [hereinafter, [redacted] *Lagoon Rupture*].

effect of agriculture waste on groundwater, drinking water, and air quality and any other environmental impacts of agriculture" and "[m]ethods of disposing of and managing agriculture waste that have fewer adverse impacts than those methods currently in use in this State, including positive commercial and noncommercial uses of agriculture waste," among other things.[13]

32. The Blue Ribbon Commission proposed a number of recommendations to reduce the impact that swine facilities have on water, air quality, and human health. The Commission recommended that the State replace the then-existing regulatory system, which deemed swine facilities permitted under the law if they met certain conditions, with a requirement that facilities apply for and obtain a permit to control waste. The general permit was intended to ensure more direct oversight and control.[14]

33. The Blue Ribbon Commission also recommended that the State do more to protect communities against odors from swine facilities,[15] enact programs to monitor swine facilities to prevent heavy metal and phosphorus pollution,[16] work to develop alternatives to the system of storing waste in open air lagoons,[17] and study the impacts that lagoons have on groundwater quality.[18]

34. In 1996, the North Carolina legislature required that the State develop a general permit program to prevent the discharge of waste from animal operations, including swine operations with 250 or more swine.[19]

35. DENR began issuing general permits for controlling swine waste management systems on January 1, 1997.[20] In 2003, the General Assembly extended the expiration date of all general permits until October 1, 2004.[21]

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[13] N.C. Sess. Law 1995-542, sec. 4.1(1), (3) (eff. July 29, 1995), *available at* http://www.ncga.state.nc.us/EnactedLegislation/SessionLaws/HTML/1995-1996/SL1995-542.html; *see also* Blue Ribbon Study Commission on Agricultural Waste, Report to the 1995 General Assembly of North Carolina, 1996 Regular Session 1 (1996), *available at* http://ncleg.net/Library/studies/1996/st10736.pdf, attached as Exhibit 38 [Blue Ribbon Study Commission].

[14] *Id.* at 24-25.

[15] *Id.* at 16.

[16] *Id.* at 19.

[17] *Id.* at 29.

[18] *Id.* at 29-30.

[19] N.C. Sess. Law 1996-626, sec. 1 (codified as amended at N.C. Gen. Stat. §§ 143-215.10A through .10*l*) (eff. as provided at sec. 19), *available at* http://www.ncga.state.nc.us/EnactedLegislation/SessionLaws/HTML/1995-1996/SL1995-626.html.

[20] Senate Bill 1217 Interagency Group, Ninth Senate Bill (SB) 1217 Interagency Group Guidance Document 7-1 (Sep. 25, 2009), *available at* http://www.ncagr.gov/SWC/tech/documents/9th_Guidance_Doc_100109.pdf.

36. DENR has since issued revised general permits, first on June 4, 2004, and again on February 20, 2009. These permits were effective from October 1, 2004 until September 30, 2009 and from October 1, 2009 until September 30, 2014, respectively.

B. **Finalization of the General Permit and DENR's Failure to Conduct a Disparate Impact Analysis**

37. In 2013, DENR published draft state permits to control animal waste, including AWG100000, the Swine Waste Management System General Permit.

38. Since at least the mid 1990s, when North Carolina charged the Blue Ribbon Commission with studying the effects of swine facilities, the State has been on notice that these operations generate massive amounts of waste that threaten the health and environment of communities that are forced to live nearby. (b) (5) Deliberative

39. Myriad scientific articles describe the ways in which the swine facilities pollute the environment and wreak havoc on human health.[22]

40. Citizens have told DENR, through meetings with the agency and formal complaints, that swine facilities are polluting their waters and air, causing them to feel sick, and preventing them from sitting outside and enjoying their property. (b) (6), Decl. ¶¶ 43-46; (b) Decl. ¶ 12; Declaration of (b) (6), (b) (7) (C) ¶ 16, attached as Exhibit 17 [(b) (6), Decl.]; (b) (6), (b) (7) Decl. ¶¶ 46-48, 50.

41. Citizens, and nonprofits working with them, have demanded stronger controls to protect them from the water and air pollution these facilities generate. *See* (b) (6), Decl. ¶¶ 43-46; (b) (6), (b) (7) Decl. ¶¶ 48, 50.

42. DENR has been invited to attend the Environmental Justice Network's annual summit, where representatives from DENR have sat on a "Community Speak Out and Government Listening" panel that allows the citizens to voice concerns about industries that affect their health and welfare, including the industrial swine industry. (b) (6), (b) (7) Decl. ¶¶ 46, 48, 50.

43. Despite repeated protests about the failures in the general permit program, DENR proposed permit terms that were largely the same as the permit that came before it. The draft offered nothing to correct the failures and protect neighboring communities from harmful pollution from permitted swine facilities.

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[21] *See* N.C. Sess. Law 2003-28, sec. 1.

[22] *See* paragraphs 74 to 128, *infra*; *see generally* Pew, Putting Meat on the Table, *supra* note 9, at 96-105 (references); Pew, Environmental Impact, *supra* note 9, at 38-44 (references).

44. On December 6, 2013, Steve Wing, Ginger T. Guidry, Sarah Hatcher, and Jessica Rinsky, from the University of North Carolina – Chapel Hill School of Public Health, submitted comments to DENR, raising the "large body of evidence documenting the negative health impacts of industrial swine operations," and calling on DENR "to reduce off-site pollution and increase transparency about animal production activities." Exhibit 2 at 1. This letter called upon DENR to modify the state general permit to prohibit "1) the management of swine waste using lagoons and spray fields, 2) the non-therapeutic use of antibiotics in livestock production, and 3) the location of animal confinements and animal waste storage in flood plains" as "the minimum required to preserve the health and well-being of rural residents near swine operations." *Id.* at 5.

45. Complainants Environmental Justice Network and Waterkeeper Alliance, along with others, also submitted comments to DENR on December 6, 2013, asking DENR to modify the proposed general permit to come into compliance with Title VI. The Comments are attached as Exhibit 3. The Comments made clear that "DENR's failure to require robust waste management technologies as a condition of the permit disproportionately impacts communities of color" and indicated that "the program must be redrawn to avoid this result." *Id.* at 2.

46. These Comments called on DENR "to assess the racial and ethnic impact of the permitting program" before finalizing the general permit and to "adopt measures that protect communities from pollution from the swine facilities." *Id.* at 6. The Comments pointed out that although swine facilities have historically had a disproportionate impact on the basis of race, "there is no evidence that DENR took steps to analyze the disparity its permitting program creates or attempted to address the disparity in any way." *Id.* at 15.

47. On March 7, 2014, DENR finalized the most recent renewal of the general permit. North Carolina, Environmental Management Commission, Department of Environment and Natural Resources, Swine Waste Management System General Permit, Permit No. AWG100000 [General Permit].

48. DENR issued the General Permit with inadequate provisions to protect human health and the environment, after nearly two decades of concern and complaints about the inadequate regulation of swine facilities.

49. On information and belief, DENR finalized the permit without analyzing the potential for disproportionate health or environmental impacts on African Americans, Latinos,

and Native Americans, as required by Title VI and EPA implementing regulations. DENR should have conducted a disproportionate impact analysis but failed to do so.[23]

C. **The Swine Waste Management System General Permit**

50. The General Permit is effective from October 1, 2014 until September 30, 2019. General Permit at 1.

51. The General Permit regulates animal waste management systems at swine facilities in North Carolina that meet the definition of animal operations, which involves 250 or more swine. 15A N.C. Admin. Code § 2T.1304; N.C. Gen. Stat. § 143-215.10B(1). Under North Carolina law, a person must have a permit to construct or operate an animal waste management system. N.C. Gen. Stat. § 143-215.1(a)(12); 15A N.C. Admin. Code § 2T.1304.

52. Animal waste management systems are defined by statute as the "combination of structures and nonstructural practices serving a feedlot[24] that provide for the collection, treatment, storage, [and] land application of animal waste." N.C. Gen. Stat. § 143-215.10B(3).

53. Animal waste management systems refer to the complete system for controlling waste the animal facility generates, from the time the waste is produced until it is utilized.[25]

54. Swine facilities obtain a certificates of coverage to operate under the General Permit.

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[23] 40 C.F.R. § 7.80(a)(1) provides, "Applicants for EPA assistance shall submit an assurance … stating that, with respect to their programs or activities, they will comply with the requirements of this part," Nondiscrimination in Programs or Activities Receiving Federal Assistance from EPA. If assurances are to be at all meaningful, this obligation requires recipients to analyze whether they are complying with Title VI and EPA's implementing regulations and, particularly, whether their programs and activities have an unjustified disproportionate impact. *See* Draft Title VI Recipient Guidance, 65 Fed. Reg. at 39,657.

[24] Under North Carolina law, the term feedlot "means a lot or building or combination of lots and buildings intended for the confined feeding, breeding, raising, or holding of animals and either specifically designed as a confinement area in which animal waste may accumulate or where the concentration of animals is such that an established vegetative cover cannot be maintained. A building or lot is not a feedlot unless animals are confined for 45 or more days, which may or may not be consecutive, in a 12-month period. Pastures shall not be considered feedlots for purposes of this Part." N.C. Gen. Stat. § 143-215.10B(5).

[25] Natural Res. Conservation Serv., USDA, Pt. 651: Agric. Waste Mgmt. Field Handbook 9-1 (2011), *available at* http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=31493.wba (defining animal waste management systems as "planned system[s]" designed "to control and use by-products of agricultural production in a manner that sustains or enhances the quality of air, water, soil, plant, animal, and energy resources").

55. Currently, more than 2,000 swine facilities hold certificates of coverage to operate under the existing general permit, which expires on September 20, 2014. The number of facilities holding a permit is not expected to change significantly under the renewal.[26]

56. The General Permit will not prevent degradation of North Carolina's ground and surface water or air, and will not protect the health of people living, working, and attending school in proximity to permitted swine facilities. (b) (6), Decl. ¶ 51; Declaration of (b) (6), (b) (6), (b) (7) ¶¶ 41-51, attached as Exhibit 14 [(b) (6), (b) Decl.].

57. Moreover, inadequate enforcement measures all but ensure the meager protections—such as the prohibition against spraying waste in the rain or on oversaturated fields—can go unheeded. (b) (6), Decl. ¶¶ 42, 48. The dwindling number of state inspectors, and lack of overtime staffing, exacerbate enforcement issues. *Id.* ¶ 47.

D. **The General Permit Does Not Require Robust Waste Management Technologies or Other Provisions to Control Pollution from Permitted Swine Facilities**

(b) (5) Deliberative

58. Chief among the failures in the current General Permit is that it continues to allow permitted swine facilities to use a lagoon and sprayfield system to control disposal of

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[26] At the time this complaint was written, DENR had not published notice of the facilities that are covered under the General Permit, however the number of permitted facilities is not expected to change significantly. In 1997, North Carolina enacted moratorium against the construction and operation of new and expanded swine facilities. *See* N.C. Sess. Law 1997-458, sec. 1.2 *available at* http://www.ncga.state.nc.us/EnactedLegislation/SessionLaws/HTML/1997-1998/SL1997-458.html. The moratorium was extended and changed over the years. *See, e.g.*, N.C. Sess. Law 1998-188, sec. 3 (amending N.C. Sess. Law 1997-458 § 1.2) (eff. Oct. 12, 1998), *available at* http://www.ncga.state.nc.us/EnactedLegislation/SessionLaws/HTML/1997-1998/SL1998-188.html; N.C. Sess. Law 1999-329, sec. 2.1 (amending N.C. Sess. Law 1997-458 § 1.2) (eff. July 20, 1999), *available at* http://www.ncga.state.nc.us/EnactedLegislation/SessionLaws/HTML/1999-2000/SL1999-329.html. Under the current law, DENR "shall not issue or modify a permit to authorize the construction, operation, or expansion of an animal waste management system that serves a swine farm that employs an anaerobic lagoon as the primary method of treatment and land application of waste by means of a sprayfield as the primary method of waste disposal." N.C. Gen. Stat. § 143-215.10I(b). Thus, new lagoons and sprayfield systems, which would otherwise be controlled under the General Permit, are prohibited. DENR may issue a permit for the construction, operation, or expansion of an animal waste management system serving a swine facility if it meets certain performance standards designed to protect the environment, *id.*, however the standards in essence prohibit lagoons and sprayfields. Moreover, any new or expanded facility would be required to meet these standards under an individual permit. Thus, the facilities operating under the current general permit represent the upper bound of facilities that will be permitted under the renewal. The number of permitted facilities will decline if an operation closes. Complainants will supplement this complaint when DENR makes available a new list of facilities covered by the General Permit.

animal waste. The lagoon and sprayfield system is a blunt instrument for controlling the staggering amount of waste generated each year at the permitted facilities. Lagoons can spill, threatening surface and groundwater, and leach pollutants into groundwater. The high volume sprayers generate a mist of manure that drifts off the fields, inundating homes, streams, and anything in its path with harmful gases and pathogens and an overwhelming smell.

59. The General Permit also does not ensure that all permitted swine facilities are meeting standards to control phosphorus pollution, focusing instead on those facilities that are "sensitive to nutrient enrichment," General Permit at 2 (Condition I.5). This condition fails to recognize that, in large part because of the swine industry, many of North Carolina's waters are oversaturated with nutrients and are sensitive to nutrient enrichment. (b) (6), (b) (7)(C) Decl. 39 & Exs. 12-17.

(b) (5) Deliberative

60. The General Permit allows permitted swine facilities to land apply waste as close as 100 feet from a well, General Permit at 3 (Condition 1.8). Far greater setbacks are required to protect drinking water sources from the waste that drifts off the sprayfields. Nitrate from swine facilities, for example, has been found to travel up to 100 meters from swine facilities, and nitrate in water can cause methemoglobinemia, or blue baby syndrome. (b) (6), (b) (7)(C) Decl. ¶¶ 45, 25.

(b) (5) Deliberative

61. The General Permit provides permitted swine facilities with up to two days to incorporate manure and sludges into bare soil, unless rainfall events are predicted, General Permit at 3 (Condition II.7). For two days, then, manure and sludges are allowed to sit on the ground, where they could run into nearby waters, all the while giving off a terrible smell.

(b) (5) Deliberative

62. The General Permit allows permitted swine facilities to "temporarily lower lagoon levels" in times of drought or wet weather without first obtaining approval and oversight from DENR, General Permit at 6 (Condition II.27). Facilities, thus, can spray additional manure from the lagoon without ensuring that the land can incorporate the additional waste. Without oversight and control, this provision all but ensures that waste will run off the sprayfields and into any nearby streams and leach into groundwater. The addition spraying generates additional manure mist that blankets the community with harmful gasses and pathogens whose presence is known with the putrid smell. *See, e.g.*, (b) (6), (b) (7)(C) Decl. ¶¶ 16, 23, 24, 36, 42.

(b) (5) Deliberative

E. **The General Permit Does Not Require Sufficient Oversight and Control of Permitted Swine Facilities**

63. The General Permit does not require rigorous oversight and reporting to ensure that permitted swine facilities are not polluting the surface and groundwater, as well as air, to the detriment of human health and welfare.

(b) (5) Deliberative

64. The General Permit does not specify the practices, beyond mere visual inspection, that must be used to ensure that the waste collection, treatment, and storage structures and the runoff control measures in place at permitted swine facilities are in proper working order and are not leaking or otherwise discharging pollutants, General Permit at 6 (Condition III.1). (b) (5) Deliberative

65. The General Permit does not uniformly require best practices to monitor the lagoons, such as automated lagoon or storage pond waste level monitors and recorders, General Permit at 6-7 (Condition III.2(b)). Only those facilities that have been found to violate requirements to maintain proper lagoon levels for two consecutive years are subject to this heightened requirement. All facilities should rigorously monitor lagoon levels to prevent catastrophic outcomes, like spills in the event of North Carolina's frequent heavy rainfall events. (b) (5) Deliberative

66. The General Permit does not require permitted swine facilities to submit an amendment to the Certified Animal Waste Management Plan to DENR for approval, and does not publish other major changes and revisions for public review, General Permit at 2 (Condition I.3). DENR, thus, is not carefully monitoring the waste management plans to ensure that swine facilities are subject to best practice. (b) (5) Deliberative

67. The General Permit does not require rigorous microbial analysis of swine waste that is applied to the fields to provide the state, the scientific community, and the public with sufficient information to understand the scope of impacts in the event of a discharge event, or to assess problems arising from normal operation. (b) (6), (b) (7) Decl. ¶ 43. Within 60 days of land applying waste, the facility must analyze "a representative sample of animal waste" for nitrogen, phosphorus, zinc, and copper. General Permit at 8 (Condition III.5). The lag time between land application and testing does not ensure that DENR, the scientific community, or the public will have accurate information about the content of animal waste in the event of a discharge. The limited microbial analysis also will not provide enough information to evaluate and respond to citizen complaints and monitor and predict potential problems. (b) (5) Deliberative

68. The General Permit does not require groundwater monitoring in the event of a "massive burial of animals," but rather makes such monitoring discretionary, General Permit at 4 (Condition I.10). Animal burial is a significant threat to surface and groundwater quality, especially in recent years, as the emergence of the porcine epidemic virus ("PED") threatens to wipe out herds of animals. (b) (6), (b) (7)(C) Decl. ¶¶ 24, 27, 32. (b) (5) Deliberative

69. The General Permit does not require public notice of a number of events that threaten human health—including failure of the waste management system causing a discharge to ditches, surface waters, and wetlands; failure of the waste management system that prohibits the system from receiving, storing, or treating additional waste; spills of waste or sludge; deterioration or leaks in the lagoon; failure to maintain storage capacity in the lagoon or below designated freeboard levels; waste application in violation of the animal waste management (b) (5) Deliberative

plan or that results in runoff to a ditch, surface water, or wetlands; and discharge to ditches, surface waters, or wetlands, General Permit at 9-10 (Condition III.13).

70. The General Permit does not require sufficient public notice in the event of a discharge of more than 1,000 gallons of waste, and even up to 1 million gallons, and does not require rigorous testing of the waste source, the receiving water body, and the soil sediment t determine the potential impact on human health, General Permit at 10-11 (Conditions III.15-17 The permit does not ensure that the waste will be sampled close enough to the discharge even to enable the agency and the public to assess the severity of the threat and the potential impac to human health. [redacted] Decl. ¶¶ 43, 46-48.

(b) (5) Deliberative

71. The General Permit establishes a system of self-monitoring, where the permitted swine facilities create, but do not submit to DENR for review nor make available to the public, the following records:

- Records of inspection of the land application site, General Permit at 5 (Condition II.17)
- Records of testing and calibration of the land application equipment, General Permit at 6 (Condition II.24)
- Records of the waste level in each lagoon, General Permit at 6 (Condition III.2);
- Records of precipitation events, General Permit at 7 (Condition III.3(a));
- Records concerning irrigation and land application events, General Permit at 8 (Condition III.6);
- Records of transfers of waste between waste structures on the same site not typically operated in series, General Permit at 8 (Condition III.7); and
- Monthly stocking records, General Permit at 8 (Condition III.8).

DENR and the public need access to these records to understand and evaluate the extent to which the swine facilities are impacting human health and the environment. [redacted] Decl. ¶¶ 43-44.

(b) (6), (b) (7)(C)

72. DENR does not have sufficient inspectors to visit the permitted swine facilitie and ensure compliance with the minimum standards to protect the environment and human

(b) (5) Deliberative

health. On information and belief, North Carolina has cut approximately 131 employees from DENR, including inspectors and other regulators, since January 2013.[27]

73. DENR's decision to issue the General Permit without adequate measures to control, dispose of, and monitor the significant amounts of animal waste and pollutants that these facilities generate threatens to pollute the state's water and air. This pollution, in turn, contributes to serious health problems among those in neighboring communities, prevents people from enjoying their land and property, and contributes to declining property values. (b) (5) Deliberative

V. ADVERSE IMPACTS

A. Swine Facilities Permitted by DENR Contribute to Surface Water Pollution that Adversely Affects Human Health and Welfare

74. The General Permit allows permitted swine facilities to use a lagoon and sprayfield system to dispose of waste.

75. Lagoons are prone to acute pollution problems, including ruptures and spills, which impair surface water quality.[28] Such contamination is also capable of harming human health. (b) (6), (b) (7)(C) Decl. ¶¶ 6-14.

76. Hurricanes in eastern North Carolina have led to severe flooding of industrial swine facilities, the rupture of lagoons, and the overflow of waste into North Carolina's creeks, rivers, and streams.[29]

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[27] Andrew Kenney & Craig Jarvis, *Cuts to DENR Regulators Jarring in Wake of Dan River Spill, News & Observer*, Mar. 7, 2014, http://www.newsobserver.com/2014/03/07/3683762/cuts-to-denr-regulators-jarring.html.

[28] *See* Michael A. Mallin & Lawrence B. Cahoon, *Industrialized Animal Production—A Major Source of Nutrient and Microbial Pollution to Aquatic Ecosystems*, 24 Population & Env't 369, 371 (2003), attached as Exhibit 41; Burkholder, *Lagoon Rupture*, *supra* note 12, at 1463 (rupture of lagoon at a facility in Jacksonville, North Carolina in 1995, releasing more than 28.5 million gallons of untreated swine waste in the New River, to the detriment of water quality); Mallin & Cahoon at 371 (in 1995, a poultry lagoon breach and a large swine lagoon leak were suspected of causing algal blooms, fish kills, and microbial contamination in North Carolina's Cape Fear River Basin).

[29] *See* Burkholder, *Lagoon Rupture*, *supra* note 12, at 1463 (in 1996, "Hurricane Fran led to severe flooding of [confined animal operations] located in coastal river floodplains, and to rupture of various lagoons in several major watersheds"); Steve Wing, et al., *The Potential Impact of Flooding on Confined Animal Feeding Operations in Eastern North Carolina*, 110 Envtl. Health Perspectives 387, 387 (2002), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1240801/pdf/ehp0110-000387.pdf (describing how the 15-20 inches of rain dropped by Hurricane Floyd turned eastern North Carolina into a fecal flood zone). The flooding following Hurricane Floyd was not an isolated incident. *Id.* ("In 1996, 22 fecal waste pits were reported to have been ruptured or inundated following flooding from Hurricane Fran, and one major spill was reported following Hurricane Bonnie in 1998.").

77. Waste spilled from overflowing lagoons and runoff from application of the waste to fields has been linked to outbreaks of harmful pathogens, such as salmonella and *E. coli* in the environment[30] has led to major freshwater fish kills, and has contributed to toxic algae outbreaks.[31] *See, e.g.*, (b) (6), (b) (7) Decl. ¶¶ 6-14.

78. The General Permit allows permitted swine facilities to use sprayfields to disperse the waste stored in their lagoons. Sprayfields also contribute to water quality impacts by introducing various pollutants, including those described in the preceding paragraph, to the water column. For example, waste can run off fields when over-applied, or when it is applied to ground that is already saturated or frozen and cannot absorb the waste.[32] (b) (6), (b) (7)(C) Decl. ¶ 16, 23, 36, 42; (b) (6), (b) (7) Decl. ¶ 30; *see also* Declaration of (b) (6), (b) (7)(C) ¶ 17, attached as Exhibit 7 [(b) (6) Decl.] (reporting improper spraying); Declaration of (b) (6), (b) (7) ¶ 13, attached as Exhibit 28 [(b) (6), (b) (7) Decl.]. Contaminants from swine waste also reach receiving waters through runoff and leach through permeable soils to vulnerable aquifers even when the waste is applied at recommended application rates. (b) (6), (b) (7) Decl. ¶ 29. Permitted swine facilities have been reported to apply waste to ditches that lead to surface waters. (b) (6), Decl. ¶ 16, 23, 35, 42. Finally, waste from the sprayers can blow directly into the surface waters. (b) (6), (b) (7)(C) Decl. ¶ 23.

79. Over-applying the waste or applying the waste to saturated or frozen ground would violate the General Permit and the associated animal waste management plans, however, many facilities are reported to engage in such practices. Without provisions requiring frequent DENR inspections of the permitted facilities in the General Permit and rigorous self-monitoring and reporting to DENR and the public, combined with increases in DENR staff to handle the additional responsibility, DENR and the public are not in a position to find and prohibit the unlawful waste application practices that threaten water quality. (b) (6), Decl. ¶¶ 45-51.

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[30] Michael Greger & Gowri Koneswaran, *The Public Health Impacts of Concentrated Animal Feeding Operations on Local Communities*, 33 Farm Cmty. Health 11, 13 (2010); Carrie Hribar, Nat'l Ass'n of Local Bds. of Health, Understanding Concentrated Animal Feeding Operations and Their Impact on Communities, Environmental Health 4 (2010), *available at* http://www.cdc.gov/nceh/ehs/docs/understanding_cafos_nalboh.pdf, attached as Exhibit 40.

[31] JoAnn M. Burkholder et al., *Impacts of Waste from CAFOs on Water Quality*, 115 Envtl. Health Perspectives 308, 309 (2007), *available at* http://dx.doi.org/10.1289/ehp.8839, attached as Exhibit 3 to (b) (6), (b) (7) Decl. [hereinafter, Burkholder, *Impacts of CAFO Waste*]; *see also* Michael A. Mallin et al., Ctr. for Marine Science Research, Univ. of N.C. at Wilmington, Effect of Organic and Inorganic Nutrient Loading on Photosynthetic and Heterotrophic Plankton Communities in Blackwater Rivers (1998), *available at* http://repository.lib.ncsu.edu/dr/bitstream/1840.4/1880/1/NC-WRRI-315.pdf; Michael A. Mallin et al., *Factors Contributing to Hypoxia in Rivers, Lakes, and Streams*, 51 Limnology & Oceanography 690, 699-700 (2006).

[32] Hribar, *supra* note 30, at 4.

80. Ammonia that is volatilized from the sprayers or the confinement houses at permitted swine facilities also degrades water quality. The airborne ammonia returns to the surface near permitted facilities, where it can land in surface waters or wash into the waters via ditches.[33] (b) (6), (b) (7) Decl. ¶¶ 32-33. For example, researchers found that industrial swine facilities contributed to ammonia pollution in the lower Neuse estuary. *Id.* ¶ 19, 34.

81. High ammonia concentrations can lead to algal blooms that are harmful to aquatic life. (b) (6), (b) (7) Decl. ¶ 34, 19. The algae themselves produce toxins that degrade water quality and impact human health. *Id.* ¶¶ 19, 40. For example, cyanobacteria make toxins that cause liver hemorrhaging as well as neurological and psychological impacts. *Id.* ¶ 40. Cyanotoxins can cause burning eyes and skin irritation, and can even promote tumor growth. *Id.* The Cape Fear River, which is impacted by many swine facilities, has experienced highly toxic cyanobacteria blooms. *Id.* ¶ 41. Scientists at the University of North Carolina, Wilmington recorded levels as high as 390 micrograms of the toxin per liter in Cape Fear, a level that far exceeds the 1 microgram per liter standard for safe drinking water put forward by the World Health Organization. *Id.*

82. Waste from permitted swine facilities has polluted waterways, forcing people to abandon favorite swimming holes and fishing ponds. In some instances, the low dissolved oxygen seen in waters oversaturated with swine waste causes the fish to suffocate, ruining a water body as a potential fishing source. (b) (6), (b) (7) Decl. ¶ 38; *see also* (b) (6), (b) (7) (C) Decl. ¶ 9. People have reported catching fish with skin infections, visible sores, and abrasions that may have been caused by water pollution from the industrial swine facilities.[34] Declaration of (b) (6), (b) (7) (b) (6), (b) ¶¶ 14-15, attached as Exhibit 36 (b) (6), Decl.]; Hall Decl. ¶ 19; Declaration of (b) (6), (b) (6), ¶ 18-20, attached as Exhibit 26 (b) (6), (b) Decl.].
(b) (7)

83. Parasites, bacteria, viruses, nitrates, and other components of liquid waste from permitted swine facilities pose threats to human health.[35] Steve Wing & Jill Johnston, Industrial

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[33] *Id.*; *see also* Marion Deerhake et al., *Atmospheric Dispersion and Deposition of Ammonia Gas*, *in* RTI Int'l, Benefits of Adopting Environmentally Superior Swine Waste Management Technologies in North Carolina: An Environmental and Economic Assessment, at 2-32 to 2-34 (2003), *available at* http://www.cals.ncsu.edu/waste_mgt/smithfield_projects/phase1report04/appendix%20c-RTI.pdf, attached as Exhibit 47 (modeling rates of ammonia deposition by county). "The greatest deposition occurs in Sampson and Duplin counties." *Id.* at 2-33.

[34] *See* JoAnn M. Burkholder & Howard B. Glasgow, *History of Toxic Pfiesteria in North Carolina Estuaries from 1991 to the Present*, 51 Biosci. 827, 833 (2001) ("During acute [Pfiesteria] exposure, fish commonly hemorrhage or develop skin lesions that are diffuse or nonfocal, as well as deep, localized or focal, bleeding sores or ulcerations.").

[35] Burkholder, *Impacts of CAFO Waste*, *supra* note 31; *see also* Dana Cole et al., *Concentrated Swine Feeding Operations and Public Health: A Review of Occupational and Community Health Effects*, 108 Envtl. Health Perspectives 685 (2000), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1638284/pdf/envhper00309-0041.pdf, attached as Exhibit 39.

Hog Operations in North Carolina Disproportionately Impact African-Americans, Hispanics and American Indians 2 (Aug. 2014), attached as Exhibit 4 [Wing & Johnston Report].

B. **Swine Facilities Permitted by DENR Contribute to Groundwater Pollution that Adversely Affects Human Health and Welfare**

84. The lagoon and sprayfield system contributes to groundwater pollution that adversely affects human health and welfare.

85. Many of the lagoons in North Carolina were built in the 1990s, before standards requiring that lagoons be lined with plastic and compacted clay were in place.[36] (b) (6), (b) (7)(C) Decl. ¶ 34; (b) (6), (b) (7)(C) Decl. ¶ 29. Lagoons have been shown to leach wastewater into the soil where

(b) (5) Deliberative

[redacted]

[36] When the swine industry in North Carolina expanded, lagoons were not required to have synthetic liners, allegedly because of the largely unproven assumption that the lagoons would develop a seal. R.L. Huffman, *Seepage Evaluation of Older Swine Lagoons in North Carolina*, 47 Trans. Am. Soc'y Agric. Eng'rs 1507, 1507 (2004) ("[L]agoons were expected to develop a seal at the liquid-soil interface that would impede seepage."); *see also* Danny McCook, Discussion of Background Considerations in the Development of Appendix 10D to the Agricultural Waste Management Field Handbook 1 (2001), *available at* https://prod.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs141p2_024282.pdf ("Prior to about 1990, NRCS engineers commonly assumed that the accumulation of manure solids and the bacterial action resulting from a sludge interface would effectively reduce seepage . . . to an acceptable level."). Assumptions about the effectiveness of natural sealing were inaccurate or overstated. *See* McCook, *supra* at 1 ("[R]esearch . . . demonstrated that . . . manure sealing . . . was not as complete as formerly believed."); *see also* Natural Res. Conservation Serv., USDA, Part 651: Agricultural Waste Management Field Handbook 10D-1 (2009), *available at* ftp.wcc.nrcs.usda.gov/wntsc/AWM/handbook/ch10.pdf ("A rule of thumb supported by research is that manure sealing is not effective unless soils have at least 15 percent clay content for monogastric animal generated waste . . . ."). The General Assembly has prohibited the construction, operation, or expansion of new anaerobic lagoons, stating that DENR is prohibited from "issu[ing] or modify[ing] a permit to authorize the construction, operation, or expansion of an animal waste management system that serves a swine farm that employs an anaerobic lagoon as the primary method of treatment and land application of waste by means of a sprayfield as the primary method of waste disposal. *See* N.C. Gen. Stat. § 143-215.10*I*(b). Furthermore, the performance standards that apply to new or expanded animal waste management systems at swine facilities specify that the system "be designed and constructed with synthetic liners to eliminate seepage." 15A N.C. Admin. Code § 2T.1307(b)(1)(A).

it can reach groundwater.[37] [redacted] Dec. ¶ 34; [redacted] Decl. ¶ 24. Studies from eastern North Carolina have shown that lagoons at swine facilities can and do contaminate shallow groundwater with antibiotic-resistant *E. coli*[38] and nitrate,[39] and ammonia.[40]

86. Liquid waste that is applied to the fields can also percolate through the sandy soils in North Carolina and into shallow groundwater. [redacted] Decl. ¶ 23.

87. Permitted facilities are allowed to operate without proper liners unless and until DENR requires their replacement.[41] [redacted]

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[37] *See, e.g.*, J.P. Murphy & J.P. Harner, *Lagoon Seepage Through Soil Liners*, *in* Swine Day 1997, at 1, 3 (Kans. State Univ. Agric. Experiment Station & Coop've Ext. Serv.), *available at* http://www.asi.k-state.edu/doc/swine-day-1997/srp795.pdf; *see also* Carol J. Hodne, Iowa Policy Project, Concentrating on Clean Water: The Challenge of Concentrated Animal Feeding Operations 8 (2005), *available at* http://www.iowapolicyproject.org/2005docs/050406-cafo-fullx.pdf. 2005docs/050406-cafo-fullx.pdf (identifying "seepage from earthen manure storage structures" as typical pathway for nitrates entering groundwater); Jerry L. Hatfield et al., Chapter 4: Swine Manure Management, *in* Agric. Research Serv., USDA, Agricultural Uses of Municipal, Animal, and Industrial Byproducts 78, 82 (1998), *available at* http://infohouse.p2ric.org/ref/43/42647.pdf (describing "leakage" as a "major environmental concern").

[38] *See* M.E. Anderson & M.D. Sobsey, *Detection and Occurrence of Antimicrobially Resistant* E. coli *in Groundwater on or near Swine Farms in Eastern North Carolina*, 54 Water Sci. & Tech. 211, 217 (2006), attached as Exhibit 37 ("Overall, the results of this study demonstrated that antibiotic-resistant E. coli were present in groundwaters associated with commercial swine farms that have anaerobic lagoons and land application systems for swine waste management.").

[39] *See* Melva Okun, Envtl. Res. Program, UNC School of Public Health, Human Health Issues Associated with the Hog Industry (1999), *available at* http://www.bape.gouv.qc.ca/sections/mandats/prod-porcine/documents/SANTE5.pdf (discussing 1996 NC DHHS well testing program, which found exceedances of 10 ppm nitrate standard in 9.9% and 22.5% of wells in Duplin and Sampson Counties, respectively); Wendee Nicole, *CAFOs and Environmental Justice: The Case of North Carolina*, 121 Envtl. Health Perspectives A182, A186 (2013), attached as Exhibit 44 ("Even without spills, ammonia and nitrates may seep into groundwater, especially in the coastal plain where the water table is near the surface.").

[40] R.L. Huffman & Phillip W. Westerman, *Estimated Seepage Losses from Established Swine Waste Lagoons in the Lower Coastal Plain of North Carolina*, 38 Trans. Am. Soc'y Agric. Eng'rs 449-453 (1995); Phillip W. Westerman et al., *Swine-Lagoon Seepage in Sandy Soil*, 38 Trans. Am. Soc'y Agric. Eng'rs 1749-1760 (1995); J.M. Ham & T.M. DeSutter, *Toward Site-Specific Design Standards for Animal-Waste Lagoons: Protecting Groundwater Quality*, 29 J. Envtl. Qual. 1721, 1721-32 (2000). Even lagoons that feature liners built to NRCS standards leach some amount of waste into nearby soils. *See* NC-NRCS, Conservation Practice Standard: Waste Treatment Lagoon (Code 359), at 5 (2009) (allowing seepage of up to "1.25 x 10^{-6} cm/sec (0.003 ft/day)"); McCook, *supra* note 36, at 4 (observing that "clay liners obviously allow some seepage").

88. Burial methods allowed under the General Permit also threaten groundwater. Permitted facilities often bury dead animals in pits on-site. Groups monitoring North Carolina's waters have reported seeing facilities burying animals close to waters of the state and in deep ditches containing groundwater, practices that threaten to contaminate groundwater sources. (b) (6), (b) (7)(C) Decl. ¶ 32 & Exs. 10 & 11. The recent spread of PED threatens to increase the mortality rate at permitted swine facilities. Greater animal deaths create a need for additional burial sites, each of which could leach pollutants and disease from the decomposing animals into groundwater. (b) (6), (b) (7)(C) Decl. ¶¶ 27-28, 32.

89. Groundwater pollution threatens human health in communities that rely on groundwater wells for drinking water.[42] (b) (6), (b) (7)(C) Decl. ¶¶ 28-29, 26. A study of the North Carolina swine industry completed in 2000 found that "[a]lmost half of all hog CAFOs are located in block groups where > 85% of households have well water."[43] High nitrate levels found in contaminated groundwater, for example, are hazardous to human health, as they contribute to methemoglobinemia, or blue baby syndrome. *See, e.g.*, (b) (6), (b) (7)(C) Decl. ¶¶ 25-27 (noting studies that have shown that the area near lagoons can be contaminated with levels of high nitrate and high ammonia, and discussing the impact on human health and the environment).

90. The threat of contaminated groundwater also injures human welfare. Many people have switched from well water to municipal water sources for fear that their wells were polluted by industrial swine facilities.[44] Where municipal water is not yet available or

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[41] A lagoon for which a permit was issued prior to 2007 "may continue to operate under . . . that permit, including any renewal [thereof]." *See* N.C. Sess. Law 2007-523, sec. 1(b) (eff. Sep. 1, 2007), *available at* http://www.ncga.state.nc.us/EnactedLegislation/SessionLaws/HTML/2007-2008/SL2007-523.html. Grandfathering is also accomplished via DENR regulations. *See* 15A N.C. Admin. Code § 2T.1304(a)(1) (requiring animal waste management systems to meet "all applicable state statutes and rules *at the time of development or design*") (emphasis added). Where DENR is willing to acknowledge that these lagoons threaten water quality and the environment, it may require facilities to obtain an individual permit, which must remedy that threat. *Id.* § 2T.0111(h)(7) (indicating that DENR can require a facility whose lagoon "has been allowed to deteriorate or leak such that it poses an immediate threat to the environment" to obtain an individual permit).

[42] Hribar, *supra* note 30, at 3-4 (discussing the risk of well water contamination for facilities near industrial animal operations, and explaining that high nitrate levels could harm infants, who are susceptible to blue baby syndrome).

[43] Steve Wing et al., *Environmental Injustice in North Carolina's Hog Industry*, 108 Envtl. Health Perspectives 225, 228 (2000), attached as Exhibit 52 [Wing, *Environmental Injustice*].

[44] Declaration of Anonymous 1 ¶ 12, attached as Exhibit 5 [Anonymous 1 Decl.]; (b) (6), (b) (7)(C) Decl. ¶ 6; Declaration of (b) (6), (b) (7)(C) ¶ 8, attached as Exhibit 8 (b) (6), (b) (7)(C) Decl.]; Declaration of (b) (6), (b) (7)(C) ¶¶ 10-11, attached as Exhibit 11 (b) (6), (b) (7)(C) Decl.]; Declaration of (b) (6), (b) (7)(C) ¶ 13, attached as Exhibit 12 (b) (6), (b) (7)(C) Decl.]; (b) (6), (b) (7)(C) Decl. ¶ 21; (b) (6), (b) (7)(C) Decl. ¶ 29; Declaration of (b) (6), (b) (7)(C) ¶ 13, attached as Exhibit 23 (b) (6), (b) (7)(C) Decl.]; Declaration of (b) (6), (b) (7)(C) ¶ 15, attached as Exhibit 25 (b) (6), (b) (7)(C) Decl.]; (b) (6), (b) (7)(C) Decl. ¶ 12.

affordable, people are forced to purchase bottled water.[45] Others, however, have stayed on well water and, despite attempts at filtering the water, are forced to deal with water that smells of eggs, a hallmark of sulfur pollution that could be caused by industrial swine facilities.[46]

C. Swine Facilities Permitted by DENR Contribute to Air Pollution that Adversely Affects Human Health and Welfare

91. Permitted swine facilities contribute to air pollution that adversely affects human health and welfare. The confinement houses at swine facilities are equipped with industrial fans that draw in air from outside and vent out air containing hundreds of pollutants, including harmful gases, aerosols, and "particles consisting of swine skin cells, feces, feed, bacteria, and fungi."[47]

92. Decomposing waste in lagoons contributes to air pollution. As the waste sits in the lagoon, it gives off malodorous or toxic gases, including ammonia,[48] nitrous oxide, and other VOCs.[49] Studies have estimated that over time, approximately 70% of the nitrogen in the lagoon will escape to the atmosphere.[50]

93. The range of air pollutants emitted from industrial swine facilities includes hydrogen sulfide, ammonia, a wide array of other VOCs, and bioaerosols including endotoxins

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[45] Declaration of [redacted] ¶ 14, attached as Exhibit 9 [redacted] Decl.]; Declaration of [redacted] ¶ 10, attached as Exhibit 20 [redacted] Decl.]; Declaration of [redacted] ¶ 10, attached as Exhibit 27 [N. [redacted] Decl.]; Declaration of [redacted] ¶ 7, attached as Exhibit 34 [redacted] Decl.]. Declaration of [redacted] ¶¶ 5-7, attached as Exhibit 21 [redacted] Decl.]; Declaration of [redacted] ¶ 12, attached as Exhibit 32 [redacted] Decl.]; *see also* Declaration of [redacted] ¶ 9, attached as Exhibit 10 [redacted] Decl.] (reporting a general concern with well water); Declaration of [redacted] ¶ 9, attached as Exhibit 15 [redacted] Decl.] (concern over well water); Declaration of [redacted] ¶ 11, attached as Exhibit 19 [redacted] Decl.].

[46] [redacted] et al., *supra* note 35, at 685; *see also* Hribar, *supra* note 30, at 5-6.

[48] *See, e.g.*, John T. Walker et al., *Atmospheric Transport and Wet Deposition of Ammonium in North Carolina*, 34 Atmospheric Env't 3,407 (2000); Jennifer K. Costanza et al., *Potential Geographic Distribution of Atmospheric Nitrogen Deposition from Intensive Livestock Production in North Carolina, USA*, 398 Sci. Total Env't 76, 77 (2008); Matias B. Vanotti & Patrick G. Hunt, Ammonia Removal from Swine Wastewater Using Immobilized Nitrifiers, *in* Proceedings of the 8th Int'l. Conf. of the FAO ESCORENA Network on Recycling of Agricultural, Municipal and Industrial Residues in Agriculture, Rennes, France 427, 428 (1998), *available at* http://www.ramiran.net/doc98/FIN-ORAL/VANOTTI.pdf.

[49] *See* James A. Zahn et al., *Air Pollution from Swine Production Facilities Differing in Waste Management Practice* 3, Proceedings of the Odors and Emission 2000 Conference (2000) (listing all types of "emissions released from stored swine manure" mentioned above).

[50] C.A. Rotz, *Management to Reduce Nitrogen Losses in Animal Production*, 82 J. Animal Sci. E119, E129 (2004).

and other respiratory irritants.[51] *See* Wing & Johnston Report at 2; (b) (6), (b) (7)(C) Decl. ¶ 31 (discussing ammonia and hydrogen sulfide pollution). These emissions create "zones of exposure . . . for human populations who live near industrial hog operations in Eastern [North Carolina]."[52]

94. High levels of ammonia are a public health concern, as ammonia readily forms fine particulate matter,[53] which "strong epidemiological evidence . . . link[s] . . . with cardiovascular-related and lung cancer mortality."[54]

95. One recent study of the impact of industrial swine operations on adults living in eastern North Carolina found that the odor and chemicals emitted from the operations, including hydrogen sulfide and endotoxins, lead to acute eye, nose, and throat irritation, increased incidents of difficulty breathing, increased wheezing, chest tightness, and nausea.[55] (b) (5) Deliberative

96. Studies have shown that people living near an industrial swine facility in North Carolina suffered elevated rates of respiratory and gastrointestinal problems, mucous membrane irritation, headaches, runny nose, sore throat, excessive coughing, diarrhea, and

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[51] Cole et al., *supra* note 35, at 686-88; Susan S. Schiffman et al., *Quantification of Odors and Odorants from Swine Operations in North Carolina*, 108 Agric. & Forest Meteorology 213 (2001); Ana M. Rule et al., *Assessment of an Aerosol Treatment To Improve Air Quality in a Swine Concentrated Animal Feeding Operation*, 39 Envtl. Sci. & Tech., 9649, 9649 (2005).

[52] Sacoby M. Wilson & Marc L. Serre, *Examination of Atmospheric Ammonia Levels Near Hog CAFOs, Homes, and Schools in Eastern North Carolina*, 41 Atmospheric Env't 4977, 4985 (2007), attached as Exhibit 49; *see also* Sacoby M. Wilson & Marc L. Serre, *Use of Passive Samplers to Measure Atmospheric Ammonia Levels in a High-density Industrial Hog Farm Area of Eastern North Carolina*, 41 Atmospheric Env't 6,074 (2007).

[53] *See* Marion Deerhake et al., *Generation of Ammonium (NH_4^+) Salt Fine Particulate Matter*, *in* RTI Int'l, *supra* note 33, at 3-2 to 3-3.

[54] EPA, National Ambient Air Quality Standards for Particulate Matter, 78 Fed. Reg. 3,086, 3,103 (Jan. 15, 2013).

[55] Leah Schinasi et al., *Air Pollution, Lung Function, and Physical Symptoms in Communities Near Concentrated Swine Feeding Operations*, 22 Epidemiology 208, 208 (2011), attached as Exhibit 48 (measuring pollutants levels and effect on 101 adults living near hog CAFOs in 16 eastern North Carolina communities); *see also* K.M. Thu, *Public Health Concerns for Neighbors of Large-Scale Swine Production Operations*, 8 J. Agric. Safety & Health 175 (2002) (synthesizing research regarding public health concerns for neighbors of industrial swine facilities, including respiratory issues associated with air pollution).

burning eyes as compared to residents in the control group that did not live near industrial livestock operations.[56]

97. Children going to school near swine facilities report more doctor-diagnosed asthma and more symptoms of wheezing than populations that are not exposed to swine facilities.[57] Adults living near swine facilities also have reported increased incidence of asthma.[58]

98. Children who attend schools where livestock odor is reported at least two times per month experience more wheezing symptoms than children who attended schools where no livestock odor was reported.[59]

99. Living near livestock production facilities has been linked to increased infant mortality due to respiratory disease.[60]

100. People living and working near permitted swine facilities have confirmed the scientific findings above. They have complained about frequent sinus problems, and bronchitis. They have trouble breathing and have suffered through frequent raw throats, runny noses, persistent, hacking coughs, burning or water eyes, and allergy attacks, issues that often

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[56] Steve Wing & Susanne Wolf, *Intensive Livestock Operations, Health, and Quality of Life Among Eastern North Carolina Residents*, 108 Envtl. Health Perspectives 233, 233 (2000), attached as Exhibit 53; *see also* Cole et al., *supra* note 35 (reviewing literature on health effects associated with swine industrial agriculture); Susan S. Schiffman et al., *Symptomatic Effects of Exposure to Diluted Air Sampled from a Swine Confinement Atmosphere on Healthy Human Subjects*, 113 Envtl. Health Perspectives 567 (2005) (finding that those exposed to diluted swine air for two 1-hour sessions were more likely to report headaches, eye irritation, and nausea than the control group that was exposed to clean air); *see also* Hribar, *supra* note 30, at 6-7 & Table 1.

[57] Maria C. Mirabelli et al., *Asthma Symptoms Among Adolescents Who Attend Public Schools That Are Located Near Confined Swine Feeding Operations*, 118 Pediatrics e66 (2006), attached as Exhibit 42 (finding students aged 12 to 14 who attended North Carolina public schools within 3 miles of industrial swine facilities reported increased asthma-related symptoms, more doctor-diagnosed asthma, and more asthma-related medical visits compared to peers at other schools); James A. Merchant et al., *Asthma and Farm Exposures in a Cohort of Rural Iowa Children*, 113 Envtl. Health Perspectives 350 (2005) (finding children living on swine farms, including large facilities with more than 500 head, experienced increased rates of asthma compared to non-exposed children; results more pronounced where swine facilities added antibiotics to feed); *see also* Wing & Johnston Report at 2; *see also* [redacted] Decl. ¶ 11; [redacted] Decl. ¶ 13; [redacted] Decl. ¶ 27; Declaration of [redacted] ¶ 7, attached as Exhibit 35 [redacted] Decl.].

[58] [redacted] Decl. ¶ 17; [redacted] Decl. ¶ 11; Declaration of [redacted] ¶ 12, attached as Exhibit 18 [redacted] Decl.]; [redacted] Decl. ¶ 12; Declaration of [redacted] ¶ 6, attached as Exhibit 31 [redacted] Decl.].

[59] Mirabelli, *supra* note 57.

[60] Stacy Sneeringer, *Does Animal Feeding Operation Pollution Hurt Public Health? A National Longitudinal Study of Health Externalities Identified by Geographic Shifts in Livestock Production*, 91 Am. J. Agric. Econ. 124, 130 (2009).

worsened when they are near swine facilities. Colds seem to last longer for those exposed to air pollution from swine facilities. The smell of the waste is nauseating.[61]

D. **Swine Facilities Permitted by DENR Depress Quality of Life**

101. The overpowering smell associated with swine facilities greatly degrades the quality of life for people living and working in the shadow of these facilities.

102. The smell from the permitted swine facilities is often unbearable. Individuals who live near swine facilities frequently are not able to open their windows, sit outside their homes on their porches or in their yards, have cookouts, or otherwise engage in routine activities because of the intense and putrid odor from the swine facilities.[62] They hold their breaths and cover their mouths if they have to go outside when the facilities are spraying. They plan walks and recreation to avoid the raw, stinking smell. They avoid cooking when the facilities are spraying, because the thought of eating when smelling takes away their appetite. They no longer hang the laundry out to dry for fear that the smell will sink into their clothes. The smell even wakes them up at night.[63]

103. There's no telling when a facility will choose to spray its waste, and neighbors receive no advance notice. Some people who live near permitted swine facilities have resigned themselves to the fact that the spraying might interrupt an outdoor gathering with friends and family, while others have given up on the idea of planning events outside entirely. Without certainty about when a facility will spray, people living near permitted facilities explain that

(b) (5) Deliberative

(b) (6) - Privacy

[62] *See, e.g.*, Steve Wing et al., *Air Pollution and Odor in Communities Near Industrial Swine Operations*, 116 Envtl. Health Perspectives 1362 (2008), attached as Exhibit 50 (study participants living within 1.5 miles of swine factory farm reported altering or ceasing normal daily activities when hydrogen sulfide concentrations, and associated hog odor, were the highest) [Wing, *Air Pollution and Odor*]; Wing & Wolf, *supra* note 56; Hribar, *supra* note 30, at 7-8.

(b) (6) - Privacy

they have to leave the windows up, or else face the possibility of returning home to a house that stinks of swine waste.[64]

104. People who are elderly, have disabilities, are sick or recovering from illness, and children are among the most affected of those who are forced to live and work near permitted swine facilities. People who are elderly or recovering from illness have been forced to stay inside, even on hot days, either because they are bedridden or because their doctors have recommended that they avoid breathing in the swine waste. People using crutches have difficulty covering their nose and mouth and thus find it difficult to go outside, even just to get the mail, when the facility is spraying and the smell is overpowering.[65] Families keep their children inside because do not want them exposed to the smell and pollution from industrial swine facilities.[66] Children complain that they would like to be outside, playing in their yards, but they simply can't bear the smell.[67] Children who live near permitted swine facilities, or whose parents work in permitted swine facilities, have been forced to suffer the embarrassment and humiliation of attending school reeking of swine waste.[68] The stench of swine waste can sink into a person's clothes and stay there for days.[69]

(b) (5) Deliberative

105. The smell from the facilities is embarrassing for those forced to live near a permitted swine facility. People who live near permitted swine facilities complain that friends and family who live farther away from the facilities refuse to come and visit because of the smell. If friends and family happen to visit on a day when the smell is particularly bad, their complaints or visible discomfort is humiliating, and the visits are short-lived.[70]

106. The waste from the permitted swine facilities not only smells, it also interferes with the quality of life. Droplets of waste from the automated sprayers form a fine mist that coats everything in its path, from clothes lines, cars parked near the sprayfield or driving by, bedroom windows and sides of homes, playing fields, and even the people themselves. Student athletes have been forced to practice sports near the sprayfields, and breathe in the terrible odor.[71]

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[64] (b) Decl. ¶ 7; (b) (6), Decl. ¶ 7; (b) (6), (b) Decl. ¶ 15; (b) (6), (b) (7) Decl. ¶ 9; (b) Decl. ¶ 20; (b) (6), Decl. ¶ 10; (b) (6), Decl. ¶¶ 9-10; (b) (6), (b) (7) Decl. ¶ 11; (b) (6), Decl. ¶ 18; (b) (6), Decl. ¶ 15; (b) (6), (b) (7) Decl. ¶¶ 5, 9.

[65] (b) Decl. ¶ 10; (b) (6), (b) Decl. ¶¶ 12, 18; (b) (6), Decl. ¶ 28; (b) (6), (b) (7) Decl. ¶¶ 7-9.

[66] (b) (6), Decl. ¶ 12; (b) (6), (b) Decl. ¶ 8; (b) (6), Decl. ¶¶ 26, 28; (b) (6), (b) Decl. ¶¶ 7, 10.

[67] (b) (6), (b) (7) Decl. ¶¶ 4-6; *see also* (b) (6), (b) Decl. ¶ 10; (b) (6), (b) (7) Decl. ¶ 10; (b) (6), Decl. ¶ 12.

[68] (b) (6), (b) (7) Decl. ¶ 11.

[69] *Id.* ¶ 14; (b) (6), (b) Decl. ¶ 61.

[70] (b) (6), Decl. ¶ 10; (b) (6), (b) Decl. ¶ 10; (b) (6), (b) (7) Decl. ¶ 7; (b) (6) Decl. ¶ 20; (b) (6), (b) Decl. ¶ 8; D. (b) (6) Decl. ¶ 26; (b) (6), Decl. ¶ 9.

[71] Anonymous 1 Decl. ¶ 14; (b) (6), Decl. ¶ 36; (b) (6), (b) Decl. ¶ 7; (b) (6), (b) Decl. ¶ 15; (b) (6), (b) (7) Decl. ¶ 14; (b) (6), Decl. ¶¶ 12-14, 21-22; (b) (6), (b) Decl. ¶ 7; (b) (6), Decl. ¶¶ 8-10; (b) (6), (b) Decl. ¶ 4; (b) (6), (b) (7) Decl. ¶ 10; (b) (6), (b) Decl. ¶ 11.

107. People living near permitted swine facilities have abandoned their favorite pastimes, like hunting or fishing, because the smell near the swine facilities is simply too much to bear, or the waters are clogged with algae. Others have are concerned that the animals they catch might not be safe to eat because they, too, might be suffering from the pollution.[72]

108. Swine facilities attract bugs and other pests, from flies to buzzards, which swarm to the waste piles and boxes of decomposing animals at swine facilities. The flies make it make it unpleasant to have gatherings outside.[73] (b) (5) Deliberative

109. For communities impacted by swine facilities, there is little escape. People living and working near permitted swine facilities have complained that they can smell the odor in their cars as they approach a sprayfield, even if their windows are tightly rolled up. In hot summer months, they race to turn off their air conditioning, in an often futile attempt to prevent the putrid air from getting into the car and making it hard to breathe.[74]

110. People attending church or community meetings, too, experience the overpowering smell. Just as at home, people must work to avoid the smell from nearby swine facilities, keeping doors and windows closed, and gathering inside for community celebrations and meetings.[75]

111. The trucks that transport animals between different confinement houses and ultimately to slaughter also interfere with quality of life. Industrial swine operations "grow" their animals in stages until they reach slaughter weight. Some operators grow swine in three stages, "farrow to wean," "wean to feeder," "feeder to finish," while others progress the animals from "farrow to feeder" and "feeder to finish," each with a new confinement house.[76] Often the animals are moved via tractor-trailers that are open to the air in places to prevent suffocation. The open air design, however, allows dust, dander, and other waste to escape, and people living nearby breathe it in. Like the odor from the waste pits and sprayers, the smell of

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[7] (b) (6), (b) (7)(C) Decl. ¶ 18; (b) (6), Decl. ¶ 30; (b) (6), (b) (7)(C) Decl. ¶ 9; (b) (6), (b) (7)(C) Decl. ¶ 11; (b) (6), Decl. ¶ 13; (b) (6), (b) (7)(C) Decl. ¶¶ 5-6; (b) (6), Decl. ¶ 17; (b) (6), (b) (7)(C) Decl. ¶ 16.

[7] (b) (6), Decl. ¶ 7; (b) (6), Decl. ¶ 7; (b) (6), Decl. ¶ 10; (b) (6), (b) (7)(C) Decl. ¶ 12; (b) (6), (b) (7)(C) Decl. ¶ 17; (b) (6), (b) (7)(C) Decl. ¶ 6; (b) (6), Decl. ¶¶ 20-21; (b) (6), Decl. ¶ 10; (b) (6), (b) (7)(C) Decl. ¶ 10; Outlaw Decl. ¶ 7; (b) (6), (b) (7)(C) Decl. ¶ 18; (b) (6), Decl. ¶ 15; *see also* (b) (6), (b) (7)(C) *supra* note 30, at 8.

[7] (b) (6), (b) (7)(C) Decl. ¶ 21; (b) (6), (b) (7)(C) Decl. ¶ 18; (b) (6), Decl. ¶ 24; (b) (6), Decl. ¶ 8; (b) (6), (b) (7)(C) Decl. ¶ 11; (b) (6), (b) (7)(C) Decl. ¶ 5; (b) (6), (b) (7)(C) Decl. ¶ 5; (b) (6), (b) (7)(C) Decl. ¶ 14.

[7] (b) (6), (b) (7)(C) Decl. ¶ 14; (b) (6), Decl. ¶ 9; (b) (6), (b) (7)(C) Decl. ¶¶ 22-23; (b) (6), Decl. ¶ 18; (b) (6), Decl. ¶¶ 10-11; Declaration of (b) (6), (b) (7)(C) ¶ 8, attached as Exhibit 22 [(b) (6), (b) (7)(C) Decl.]; (b) (6), Decl. ¶ 14; (b) (6), (b) (7)(C) Decl. ¶ 12; (b) (6), Decl. ¶ 16; (b) (6), (b) (7)(C) Decl. ¶ 9.

[76] *See, e.g.*, NCDENR, Animal Feeding Operations, List of Permitted Animal Facilities (showing facilities permitted to manage waste from swine facilities at the different stages of operation); (b) (6), (b) (7)(C) Decl. ¶ 38.

the trucks is overpowering. The trucks rumble through communities at all times of day, disturbing people as they try to sleep and enjoy their lives.[77] .

112. Dead boxes, a descriptive term for the dumpsters that permitted swine facilities use to collect mortalities before their ultimate disposal, are another nuisance. Many facilities leave their dead boxes open or ajar, inviting buzzards, other scavengers, and flies, and giving off a powerfully bad smell. Even closed dead boxes smell terrible and invite pests. Many dead boxes are not well sealed and leak a smelly, potentially harmful liquid containing fluids from the decomposing animals and moisture from the environment.[78] The smell from trucks carrying dead animals is another assault on the community's senses.[79]

(b) (5) Deliberative

113. The swine industry divides communities, often pitting those employed by the swine industry who are afraid or unwilling to speak out against friends and family who want better.[80] The swine industry is a constant weight on the community, a frequent topic of conversation among those who wonder why they are forced to fight for basic rights.[81]

114. It should come as little surprise, then, given the many problems described above, that scientists have found that those living near swine facilities report more tension, more depression, more anger, less vigor, more fatigue, and more confusion than control subjects who were not exposed to industrial animal production.[82]

115. Hydrogen sulfide concentrations near swine facilities also have been associated with increased stress and anxiety,[83] as well as acute elevation of systolic blood pressure.[84]

E. **Proximity to Swine Facilities Permitted by DENR Depresses Property Values**

116. Studies across the country, including from North Carolina, have demonstrated a statistically significant relationship between proximity to a swine facility and declining property

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[77] (b) (6), Decl. ¶ 38; (b) (6), (b) Decl. ¶¶ 4-5; (b) (6), (b) Decl. ¶¶ 11-12; (b) (6), (b) Decl. ¶ 8
[78] (b) (6), Decl. ¶¶ 29-30 & Exs. 8-9; (b) (6), (b) (C) Decl. ¶ 17; (b) (6), (b) (7)(C) Decl. ¶ 11.
[79] (b) (7) Decl. ¶ 23 (b) (6), Decl. ¶ 9.
[80] (b) (6), Decl. ¶ 37.
[81] Anonymous 1 Decl. ¶16; (b) Decl. ¶ 18; (b) (6), (b) Decl. ¶ 13; (b) (6), (b) Decl. ¶ 17; T.N. Brinson Decl. ¶ 7; (b) (6), Decl. ¶ 20; (b) (6), (b) Decl. ¶ 65; (b) (6), Decl. ¶ 7; (b) (6), (b) Decl. ¶ 5.
[82] Susan S. Schiffman et al., *The Effect of Environmental Odors Emanating from Commercial Swine Operations on the Mood of Nearby Residents*, 37 Brain Research Bull. 369 (1995); *see also* Wing, *Air Pollution and Odor*, *supra* note 62 (finding that when hog odor was the strongest, study participants more frequently reported feeling stressed, gloomy, angry and unable to concentrate).
[83] Rachel Avery Horton et al., *Malodor as a Trigger of Stress and Negative Mood in Neighbors of Industrial Hog Operations*, 99 Am. J. Pub. Health Suppl., S610 (2009).
[84] Steve Wing et al., *Air Pollution from Industrial Swine Operations and Blood Pressure of Neighboring Residents*, 121 Envtl. Health Perspectives 92 (2013), attached as Exhibit 51.

values.[85] Research suggests that property values decline with increasing proximity to a swine facility, and with the increasing number of swine at a facility.[86]

117. Individuals in North Carolina fear that the value of their property has declined and that they will not be able to sell their property and move away because of neighboring industrial swine facilities.[87]

F. **Swine Facilities Permitted by DENR Can Spread Antibiotic Resistant Bacteria, which Threatens Human Health**

118. Many swine facilities use antibiotics to promote growth and to preemptively ward off the threat of disease.[88] The overuse of antibiotics in livestock production is linked to emergence of antibiotic-resistant bacteria that make infections in humans more difficult to treat. *See* Wing & Johnston Report at 2.[89]

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[85] *See* Raymond Palmquist et al., *Hog Operations, Environmental Effects, and Residential Property Values*, 73 Land Econ. 114 (1997) (studying relationship between swine factory farms and property values in nine southeastern North Carolina counties and finding that effect on price depended on number and distance of nearby factory farms); Katherine Milla et al., *Evaluating the Effect of Proximity to Hog Farms on Residential Property Values: A GIS-Based Hedonic Model Approach*, 17 URISA J. 27 (2005) (finding that values of Craven County, North Carolina homes decreased with increasing local hog populations and decreasing distances from homes to factory farms); Jungik Kim & Peter Goldsmith, *A Spatial Hedonic Approach to Assess the Impact of Swine Production on Residential Property Values*, 42 Envtl & Res. Econ. 509 (2009) (estimating decline in Craven County home property values on per hog basis); Joseph Herriges et al., *Living with Hogs in Iowa: The Impact of Livestock Facilities on Rural Residential Property Values*, 81 Land Econ. 530 (2005).

[86] *See* Palmquist et al., *supra* note 85; Milla et al., *supra* note 85.

[87] Anonymous Decl. ¶ 15; (b) Decl. ¶ 12; (b) (6), (b) (7)(C) Decl. ¶ 19; (b) (6), (b) (7)(C) Decl. ¶ 10; (b) (6), (b) (7)(C) Decl. ¶ 5; (b) (6), (b) Decl. ¶ 7; (b) (6), (b) (7) Decl. ¶ 9

[88] James M. MacDonald & William D. McBride, USDA, The Transformation of U.S. Livestock Agriculture: Scale, Efficiency, and Risks 32-35 (2009), *available at* http://www.ers.usda.gov/media/184977/eib43.pdf.

[89] *See* EK Silbergeld & LB Price LB, *Industrial Food Animal Production, Antimicrobial Resistance, and Human Health*, 29 Ann. Rev. of Pub. Health 151 (2008).

119. Antibiotic-resistant bacteria capable of causing human disease have been found in air emissions from industrial swine facilities.[90]

120. Antibiotic-resistant bacteria associated with industrial livestock production also can be transmitted through water. A recent water quality study found that samples taken near industrial animal facilities were more likely to contain multi-drug resistant bacteria than water sampled elsewhere.[91]

121. Studies have found a specific strain of methicillin-resistant *Staphylococcus aureus* ("MRSA") in both swine and people who work in the swine industry.[92] In addition, a recent study of medical records in Pennsylvania showed that people living near industrial swine

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[90] Amy Chapin et al., *Airborne Multidrug-Resistant Bacteria Isolated from a Concentrated Swine Feeding Operation*, 113 Envtl. Health Perspectives 137 (2005) (finding multidrug-resistant *Enterococcus*, coagulase-negative staphylococci, and viridans group streptococci in the air of an industrial swine operation at levels dangerous to human health); Shawn G. Gibbs et al., *Airborne Antibiotic Resistant and Nonresistant Bacteria and Fungi Recovered from Two Swine Herd Confined Animal Feeding Operations*, 1 J. Occupational & Envtl. Hygiene 699 (2004) (finding multidrug-resistant bacteria inside and downwind of industrial swine operations at levels previously determined to pose a human health hazard); Julia R. Barrett, *Airborne Bacteria in CAFOs: Transfer of Resistance from Animals to Humans*, 113 Envtl. Health Perspectives A116 (2005) (reviewing literature on cross-species transfer of antibiotic-resistant bacteria); Jochen Schulz et al., *Longitudinal Study of the Contamination of Air and of Soil Surfaces in the Vicinity of Pig Barns by Livestock-Associated Methicillin-Resistant* Staphylococcus aureus, 78 Applied Envtl. Microbiol. 5666 (2012) (detecting MRSA 300 feet from a barn in which animals, air, and workers' plastic boots tested positive for MRSA); Shawn G. Gibbs et al., *Isolation of Antibiotic-Resistant Bacteria from the Air Plume Downwind of a Swine Confined or Concentrated Animal Feeding Operation*, 114 Envtl. Health Perspectives 1032 (2006).

[91] Bridgett M. West et al., *Antibiotic Resistance, Gene Transfer, and Water Quality Patterns Observed in Waterways Near CAFO Farms and Wastewater Treatment Facilities*, 217 Water Air Soil Pollution 473 (2011).

[92] Tara C. Smith et al., *Methicillin-Resistant* Staphylococcus auereus *(MRSA) Strain ST398 Is Present in Midwestern U.S. Swine and Swine Workers*, 4 PLoS One e4258 (2009); Tara C. Smith et al., *Methicillin-Resistant* Staphylococcus aureus *in Pigs and Farm Workers on Conventional and Antibiotic-Free Swine Farms in the USA*, 8 PLoS One e63704 (2013); Jessica L. Rinsky et al., *Livestock-Associated Methicillin and Multidrug Resistant* Staphylococcus aureus *Is Present Among Industrial, Not Antibiotic-Free Livestock Operation Workers in North Carolina*, 8 PLoS One e67641 (2013); Xander W. Huijsdens et al., *Community-Acquired MRSA and Pig-Farming*, 5 Annals Clinical Microbiol. & Antimicrobials 26 (2006) (Netherlands); Ingrid V.F. Van den Broek et al., *Methicillin-Resistant* Staphylococcus aureus *in People Living and Working in Pig Farms*, 137 J. Epidem. & Infection 700 (2009) (Netherlands); Oliver Denis et al., *Methicillin-Resistant* Staphylococcus aureus *ST398 in Swine Farm Personnel, Belgium*, 15 Emerging Infectious Diseases 1098 (2009) (Belgium); T. Khanna et al., *Methicillin Resistant* Staphylococcus aureus *Colonization in Pigs and Pig Farmers*, 128 J. Veterinary Microbiol. 298 (2008) (Canada).

facility liquid waste application sites received treatment for more skin and soft tissue infections and infections caused by MRSA than people who lived further away from application sites.[93]

122. The emergence and proliferation of new strains of antibiotic-resistant bacteria is a significant threat to human health. Each year more than 2 million people in the United States acquire a serious infection that is resistant to antibiotics, and at least 23,000 people die each year as a result of those infections.[94] Among those infections, "MRSA infections can be very serious and the number of infections is among the highest of all antibiotic-resistant threats."[95]

G. Pollution from Swine Facilities Permitted by DENR Adversely Affects Sensitive Populations That Are Exposed to Other Waste Sources

123. Swine facilities are often located in communities that are overburdened with other polluting livestock operations, including poultry operations.[96]

124. Poultry operations are of significant concern for the community. Many poultry operations use a dry waste management system, as opposed to the wet lagoon system favored by the swine industry. The confinement houses are lined with bedding that absorbs the waste. The bedding is stored in piles before it is land-applied as fertilizer. Poultry confinement houses emit significant amounts ammonia and fine particles consisting of bits of manure-laden bedding, animal dander, dust, and feathers.[97] These emissions contribute to the health and welfare problems described above.

125. These same poultry facilities also attract houseflies, which may contribute to the dispersion of drug resistant bacteria.[98]

126. For people living near these facilities, the way the poultry facilities store and apply the waste is a particular concern. Often, facilities store the dry litter waste outside and uncovered, where it can drift or leach pollutants into the soil. In one study, researchers found chemicals from an uncovered litter pile at a turkey facility in the soil up to two feet below the

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[93] Joan A. Casey, *High-Density Livestock Operations, Crop Field Application of Manure, and Risk of Community-Associated Methicillin-Resistant* Staphylococcus aureus *Infection in Pennsylvania*, 173 J. Am. Med Ass'n: Internal Med. 1980 (2013).

[94] Ctrs. for Disease Control, U.S. Dep't of Health and Human Servs., Antibiotic Resistance Threats in the United States, 2013, at 6 (2013), *available at* http://www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf.

[95] *Id.* at 20.

[96] (b) (6), Decl. ¶ 25; (b) (6), (b) Decl. ¶ 3; (b) (6), (b) (7) Decl. ¶ 4; (b) (6) Decl. ¶ 8; (b) (6), (b) (7) Decl. ¶ 10.

[97] (b) (6), Decl. ¶ 25-26, 41.

[98] National Association of Local Boards of Health, Understanding Concentrated Animal Feeding Operations, at 8 (2010), *available at* http://www.cdc.gov/nceh/ehs/docs/understanding_cafos_nalboh.pdf.

surface.[99] Ammonium concentrations in the soil were 62 times higher beneath the litter pile than in the soil outside of the litter pile footprint. Arsenic concentrations were also elevated.[100] Soils near industrial swine facilities also can be polluted with metals,[101] thus the comingling of the operations increases the burden on the environment.

127. The facilities land apply the waste, but, because the waste is dry, it can drift off the fields, and over to neighboring houses.[102] The proximity of poultry and swine facilities to one another also raises the risk that land will be oversaturated with applications of swine manure and dry litter.

128. Processing and packaging plants, rendering plants, and slaughterhouses add to the burdens borne by communities near permitted swine facilities. The smell from these facilities is another injury foisted on communities living in near industrial swine facilities.[103]

VI. DISPROPORTIONALITY

A. Permitted Swine Facilities Disproportionately Affect African Americans, Latinos, and Native Americans

129. In North Carolina, permitted swine facilities adversely affect a disproportionate number of African Americans, Latinos, and Native Americans as compared to the general population.[104]

130. More than 2000 swine facilities hold a certificate of coverage allowing them to operate their waste management systems. These certificates were issued under the current swine waste management system general permit, which expires on September 30, 2014. The number and location of swine facilities is not expected to change significantly with this new permitting cycle.

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[99] N.C. Coop. Ext., Poultry Waste Stockpiling Methods: Environmental Impacts and Their Mitigation 4 (2013), *available at* https://www.bae.ncsu.edu/extension/ext-publications/air_quality/ag-788w-waste-stockpiling-shah.pdf.

[100] *Id.*

[101] (b) (6), (b) Decl. ¶ 31.

[102] (b) (6), Decl. ¶ 10.

[103] (b) Decl. ¶ 13; (b) (6), (b) (7)(C) Decl. ¶¶ 28-29; (b) (6), (b) Decl. ¶ 14; (b) (6), Decl. ¶ 21.

[104] *See* Wing & Johnston Report; *see also* Maria C. Mirabelli et al., *Race, Poverty, and Potential Exposure of Middle-School Students to Air Emissions from Confined Swine Feeding Operations*, 114 Envtl. Health Perspectives 591, 595 (2006), attached as Exhibit 43 (finding that North Carolina's swine facilities are located closer to schools enrolling higher percentages of non-white and economically disadvantaged students); Wing, *Environmental Injustice*, *supra* note 43 (finding that North Carolina's intensive hog confinement operations are located disproportionately in communities with higher levels of poverty, higher proportions of non-white persons, and higher dependence on wells for household water supply).

131. Analyses based on a study area that excludes the state's five major cities and western counties that have no presence of this industry show that the proportion of people of color[105] living within 3 miles of an industrial swine facility is 1.52 times higher than the proportion of non-Hispanic Whites. *See* Wing & Johnston Report at 5, 14 (Table 3). The proportions of African Americans,[106] Latinos,[107] and Native Americans[108] living within 3 miles of an industrial swine facility are 1.54, 1.39, and 2.18 times higher, respectively, than the proportion of non-Hispanic Whites. *Id.* These disparities are statistically significant. *Id.*

132. Analysis of the population statewide yields consistent results. The proportions of African Americans, Latinos, and Native Americans statewide living within 3 miles of an industrial swine facility are 1.4, 1.26, and 2.39 times higher than the percentage of non-Hispanic Whites, respectively. Wing & Johnston Report at 6, 13 (Table 2). These disparities are also statistically significant. *Id.*

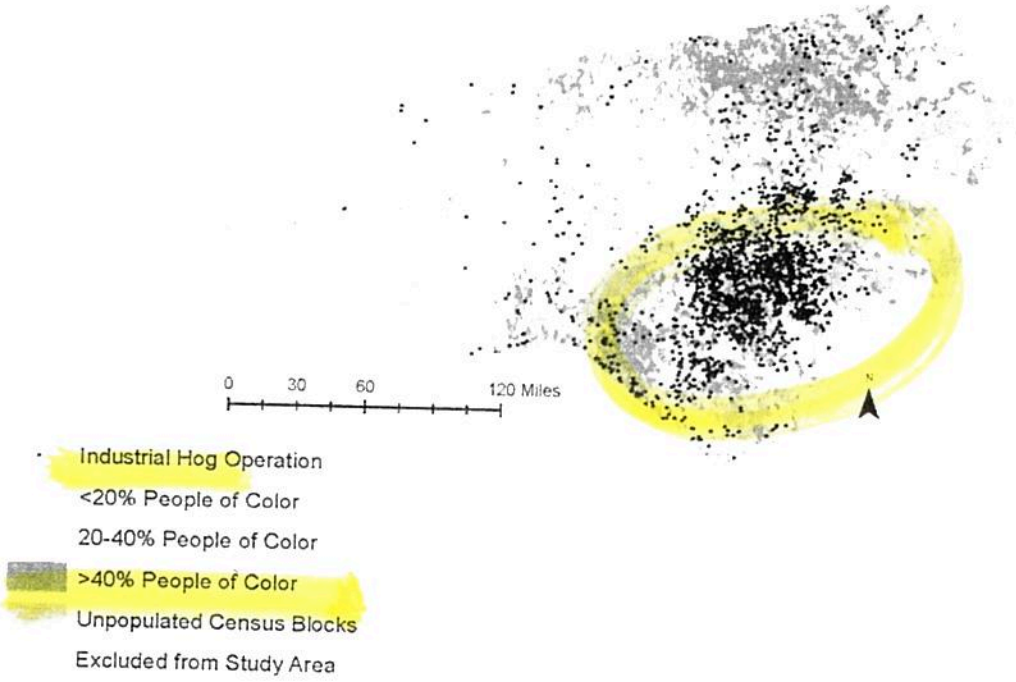
133. As shown in the following figure, which depicts the relationship of industrial swine facilities to the racial and ethnic composition of North Carolina, swine facilities are clustered in communities of color. *See* Wing & Johnston Report at 7, 12 (Figure 3).

(b) (5) Deliberative

[redacted]

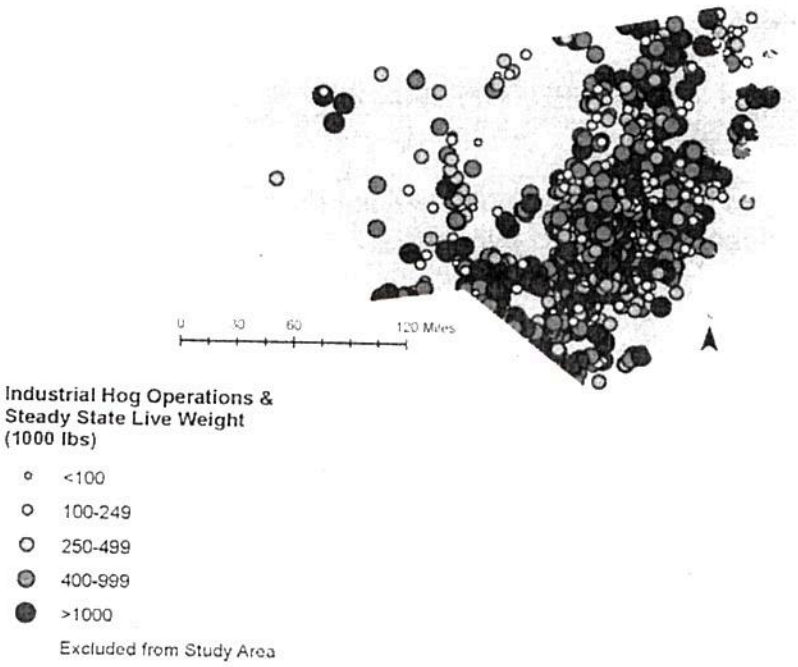
[105] In the Wing and Johnston Report, the term people of color referred to all people who identified as other than non-Hispanic white in the 2010 census data. Wing & Johnston Report at 4.
[106] The term African American used herein corresponds to the term Black as used in the Wing and Johnston Report. In the Report, the Black racial category referred to those who identified as African American or black without any other race in the 2010 census data. Wing & Johnston Report at 4.
[107] The term Latino used herein corresponds to the term Hispanic as used in the Wing and Johnston Report.
[108] The term Native American used herein corresponds to the term American Indian as used in the Wing and Johnston Report. In the Report, the term American Indian referred to those who identified themselves as American Indian without any other race in the 2010 census data. Wing & Johnston Report at 4.

Racial Composition of Census Blocks and the Locations of NC Industrial Swine Facilities Operating Under the General Permit, 2014



134. Moreover, the amount of swine waste is also greater in communities of color. Wing & Johnston Report at 6-7, 16 (Table 7). Each permitted facility is allowed to house a certain number and type of swine, and based on these factors, some facilities can be expected to produce more feces and urine than others. Steady state live weight is an indicator of the amount of waste a facility is likely to produce. The following figure depicts the distribution of steady state live weight across the state.

Industrial Swine Facilities by Steady State Live Weight



135. The swine industry's disproportionate impact on communities of color has long been known and documented. A study examining the relationship between race and the spatial concentration of swine waste in eastern North Carolina between 1982 and 1997 found evidence that "minority communities and localities lacking the political capacity to resist are shouldering

the bulk of the adverse economic, social, and environmental impacts of the pork industry restructuring."[109]

136. A later study found that there were more than seven times more industrial swine facilities in areas where there was more poverty and high percentages of non-white people.[110]

137. Research on school distribution in North Carolina also has shown that swine facilities overburden communities of color. The research has found that schools in lower income areas with a larger non-white population are more likely to be sited near an industrial livestock operation than other schools in the state.[111]

B. **African Americans**

138. African Americans in North Carolina are disproportionately adversely impacted by permitted swine facilities compared to non-Hispanic Whites and the total population.

139. The proportion of African Americans living within 3 miles of an industrial swine facility is 1.54 times higher than the proportion of non-Hispanic Whites in a study area that excludes the state's five major cities and western counties that have no presence of this industry. Wing & Johnston Report at 5, 14 (Table 3).

140. Statewide, the proportion of African Americans living within 3 miles of an industrial swine facility is 1.40 times higher than the proportion of non-Hispanic Whites. Wing & Johnston Report at 6, 13 (Table 2).

141. The ratios of African Americans living within 3 miles of an industrial swine facility as compared to non-Hispanic Whites in the study area and statewide area are statistically significant. Wing & Johnston Report at 5-6.

142. African Americans make up a larger proportion of the population living in proximity to industrial swine facilities than the proportion of the population living more than 3

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[109] Bob Edwards & Anthony E. Ladd, *Race, Class, Political Capacity and the Spatial Distribution of Swine Waste in North Carolina*, 1982-1997, 9 N.C. Geographer 51, 51 (2001).

[110] Wing, *Environmental Injustice*, *supra* note 43, at 225.

[111] Maria C. Mirabelli et al., *Race, Poverty, and Potential Exposure of Middle-School Students to Air Emissions from Confined Swine Feeding Operations*, 114 Envtl. Health Perspectives 591 (2006) (finding schools in North Carolina with white student population less than 63% and subsidized-lunch eligible population greater than 47% were more likely to be located within 3 miles of a factory farm than were schools with high-white or high-socioeconomic status populations); Paul B. Stretesky et al., *Environmental Inequity: An Analysis of Large-Scale Hog Operations in 17 States, 1982-1997*, 68 Rural Soc. 231 (2003) (finding that between 1982 and 1997 large-scale hog operations in North Carolina were more likely to be sited in areas with a disproportionate number of black residents).

miles away from any facility. The disparities are statistically significant. Wing & Johnston Report at 13 (Table 2).

143. In addition, as more African Americans are represented in a community, it is more likely that all members of the community will be exposed to swine facilities permitted by DENR. For every ten percent increase in the population of African Americans in a community, the proportion of people living within 3 miles of an industrial swine facility increases on average by 9.4%. This relationship between race and living near a facility is statistically significant. Wing & Johnston Report at 6, 15 (Table 6).

144. Adjusted for population density takes into account the fact that African Americans live in less rural areas than non-Hispanic Whites and are therefore less exposed to agricultural operations than they would be if they were more rural. With this adjustment, areas that are more than 80% African American, the proportion of people living within three miles of an industrial swine facility is more than three times the proportion in areas that have no African Americans. This disparity is statistically significant. Wing & Johnston Report at 6, 15 (Table 5).

145. The amount of hog waste in a community also increases as the percent of African Americans in the community increases. Adjusted for population density, areas with more than 40% African American residents have an excess steady state live weight compared to areas with no African American residents—they have between 493,000 and 620,000 more pounds of swine within 3 miles than areas with no African American residents. Wing & Johnston Report at 7, 16 (Table 8). The disparity is statistically significant. *Id.* Adjusted for population density, the steady state live weight of swine within 3 miles of a community increases, on average, over sixty four thousand pounds for every ten percent increase in the percentage of African Americans in a community. Wing & Johnston Report at 7, 16 (Table 9). The larger or more numerous the swine, the more waste they generate. Thus, African American communities are exposed to more detrimental operations than other communities.

C. **Latinos**

146. Latinos in North Carolina are disproportionately adversely impacted by permitted swine facilities compared to non-Hispanic Whites and the total population.

147. Latinos, on average, are more likely to live within three miles of a permitted swine facility than non-Hispanic Whites. Analyses based on a study area that excludes the state's five major cities and western counties that have no presence of this industry show that the proportion of Latinos living within 3 miles of a permitted swine facility is 1.39 times higher than the proportion of non-Hispanic Whites within the same distance of a permitted swine facility. Wing & Johnston Report at 5, 14 (Table 3).

148. Statewide, the proportion of Latinos living within 3 miles of an industrial swine facility is 1.26 times higher than the proportion of non-Hispanic Whites. Wing & Johnston Report at 6, 13 (Table 2).

149. The ratios of Latinos living within 3 miles of an industrial swine facility as compared to non-Hispanic Whites in the study area and statewide area are statistically significant. Wing & Johnston Report at 5-6.

150. Latinos make up a larger proportion of the population living in proximity to industrial swine facilities than the proportion of the population living more than 3 miles away from any facility. The disparities are statistically significant. Wing & Johnston Report at 13 (Table 2).

151. In addition, as more Latinos are represented in a community, it is more likely that all members of the community will be exposed to swine facilities permitted by DENR. For every ten percent increase in the population of Latinos in a community, the proportion of people living within 3 miles of an industrial swine facility increases on average by 8.5%. This relationship between race and living near a facility is statistically significant. Wing & Johnston Report at 6, 15 (Table 6).

152. The amount of swine waste in a community also increases as the percent of Latinos increases. Adjusted for population density, the steady state live weight of swine within 3 miles of a community increases, on average, over two hundred and forty two thousand pounds for every ten percent increase in the percentage of Latinos in a community. Wing & Johnston Report at 7, 16 (Table 9). This relationship is statistically significant. The larger or more numerous the swine, the more waste they generate. Thus, Latinos communities are exposed to more detrimental operations than other communities.

D. **Native Americans**

153. Native Americans in North Carolina are disproportionately adversely impacted by permitted swine facilities compared to non-Hispanic Whites and the total population.

154. Native Americans, on average, are more likely to live within three miles of a permitted swine facility than non-Hispanic Whites. Analyses based on a study area that excludes the state's five major cities and western counties that have no presence of this industry show that the proportion of Native Americans living within 3 miles of a permitted swine facility is 2.18 times higher than the proportion of non-Hispanic Whites within the same distance of a permitted swine facility. Wing & Johnston Report at 5, 14 (Table 3).

155. Statewide, the proportion of Native Americans living within 3 miles of an industrial swine facility is 2.39 times higher than the proportion of non-Hispanic Whites. Wing & Johnston Report at 6, 13 (Table 2).

156. The ratios of Native Americans living within 3 miles of an industrial swine facility as compared to non-Hispanic Whites in the study area and statewide area are statistically significant. Wing & Johnston Report at 5-6.

157. Native Americans make up a larger proportion of the population living in proximity to industrial swine operations than the proportion of the population living more than 3 miles away from any facility. The disparities are statistically significant. Wing & Johnston Report 13 (Table 2).

158. In addition, as more Native Americans are represented in a community, it is more likely that all members of the community will be exposed to swine facilities permitted by DENR. For every ten percent increase in the population of Native Americans in a community, the proportion of people living within 3 miles of an industrial swine facility increases on average by 16.2%. This relationship between race and living near a facility is statistically significant. Wing & Johnston Report at 6, 15 (Table 6).

159. The amount of swine waste in a community also increases as the percent of Native Americans increases. Adjusted for population density, the steady state live weight of swine within 3 miles of a community increases, on average, over ninety two thousand pounds for every ten percent increase in the percentage of Native Americans in a community. Wing & Johnston Report at 7, 16 (Table 9). The larger or more numerous the swine, the more waste they generate, and there are greater quantities of this waste in communities with more Native Americans.

VII. LESS DISCRIMINATORY ALTERNATIVES

160. DENR should exercise its authority to require permitted swine facilities to install and operate waste management systems that protect communities from pollution and include sufficient monitoring and public reporting to ensure that the goals of protecting public health and the environment are met.[112]

161. DENR is charged by state law to protect the environment and human health from pollution from the swine industry. N.C. Gen. Stat. § 143-215(a)(12) (requiring animal waste management systems to obtain a permit from the EMC of DENR for construction and

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[112] *See generally* Doug Gurian-Sherman, Union of Concerned Scientists, CAFOs Uncovered: The Untold Costs of Confined Animal Feeding Operations (2008), *available at* http://www.ucsusa.org/assets/documents/food_and_agriculture/cafos-uncovered.pdf (discussing the substantial cost of confined animal feeding operations and discussing alternatives).

operation).[113] In particular, the North Carolina legislature intended to "establish a permitting program for animal waste management systems that will protect water quality and promote innovative systems and practices." *Id.* § 143-215.10A.

162. DENR has authority to condition the permitting program to achieve the broad purposes of the air and water conservation laws, including "conserv[ing] … [the state's] air and water resources," "maintain[ing] for the citizens of the State a total environment of superior quality," "protect[ing] human health," "prevent[ing] damage to public and private property," and "secur[ing] for the people of North Carolina, now and in the future, the beneficial uses of [the State's] great natural resources." N.C. Gen. Stat. § 143-215.1(b)(4)(a) (authority to condition permits to achieve the goals of Article 21, water and air resources); *id.* § 143-21(a)-(c) (declaring the goals of Article 21); *see also* 15A N.C. Admin. Code § 02T.0108(b)(1) (same).

163. Among its powers, DENR has the authority to "require any monitoring and reporting (including but not limited to groundwater, surface water or wetland, waste sludge, soil, lagoon/storage pond levels and plant tissue) necessary to determine the source, quantity, quality, and effect of animal waste upon the surface waters, groundwaters, or wetlands." 15A N.C. Admin. Code § 02T.0108(c).

164. DENR should condition the operation of swine facilities on practices that are consistent with the protection of public health and the environment.[114] For example, DENR has the authority to require facilities to install controls on the confinement houses that filter the air, which is laden with dust particles consisting of swine skin cells, feces, feed, fungi, gases, and (often antibiotic-resistant[115]) bacteria, before it is emitted to the ambient air.[116] Air pollution is a large byproduct of these animal systems that should be addressed under a comprehensive program to address animal waste.[117]

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[113] The statute requires animal waste management systems to obtain a DENR-issued permit. *See* N.C. Gen. Stat. § 143-212(2); *id.* § 143B-282(a)(1)(a) (creating the EMC of DENR). DENR's regulations further require all animal waste management systems that meet the definition of animal operations, including swine facilities with more than 250 swine, to obtain a state-issued permit. *See* 15A N.C. Admin. Code § 2T.1304; N.C. Gen. Stat. § 143-215.10B(1) (defining animal operation).

[114] *See* Exhibit 3 (list of less discriminatory alternatives to the proposed general permit offered by Complainants Environmental Justice Network and Waterkeeper Alliance, Inc., as well as Southern Environmental Law Center, in December 6, 2013 Comments to DENR).

[115] *See generally* paragraphs 118 to 122, *supra*.

[116] *See* Natural Res. Conservation Serv., USDA Conservation Practice Standard: Air Filtration and Scrubbing (Code 371), at 3 (2010) (describing various "device[s] or system[s] for reducing [air] emissions . . . from a structure via interception and/or collection").

[117] DENR has the authority to control pollutants that are emitted first into the air that later are washed into waters under laws designed to protect water quality. *Rose Acre Farms, Inc. v. NC Dep't of Env't & Natural Res.*, 12-CVS-10, slip op. at 8-9 (Hyde Cnty. Sup. Ct. Jan. 7, 2013).

165. DENR also has the authority to require facilities to improve their waste collection systems by avoiding consolidation of solid and liquid swine waste, which creates harmful ammonia gas.[118] Manure conveyor belts or other systems that drain the urine from the feces have proven effective as retrofits to existing barns.[119]

166. In addition, DENR has the authority to require improvements to waste storage systems. At a minimum, DENR could require facilities to cover existing lagoons to prevent gases from volatilizing.

167. DENR has the authority to require facilities to use alternative treatment methods more appropriate than open-air lagoons.[120]

168. DENR has the authority to prohibit the use of high pressure spray guns, which create fine droplets and aerosols that can drift and cause odor problems, in favor of drip irrigators, or other irrigation mechanisms that do not rely on sprayers.[121] (b) (6), (b) (7)(C) Decl. ¶ 51.

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[118] A.L. Elliott et al., *Best Management Practices (BMPs) for Ammonia Emissions Reductions from Animal Feeding Operations: A Colorado Case Study*, 7 W. Nutrient Mgmt. Conf. 124, 124 (2007) ("[U]rea nitrogen in urine combines with the urease enzyme in feces and rapidly hydrolyzes to form ammonia gas. The reaction is quick, taking anywhere from 2 to 10 hours for ammonia volatilization to peak after mixing of urine and feces."); Pius M. Ndegwa et al., *A Review of Ammonia Emission Mitigation Techniques For Concentrated Animal Feeding Operations*, 100 Biosys. Eng'g 453, 465 (2008) (assessing several urine-feces segregation methods, all of which "reduced [ammonia] emissions from livestock barns by about 50% compared to the conventional manure handling system").

[119] Ndegwa, *supra* note 118, at 455-56.

[120] *See, e.g.*, Kelsi Bracmort, Cong. Research Serv., Anaerobic Digestion: Greenhouse Gas Emission Reduction and Energy Generation (2010), *available at* http://nationalaglawcenter.org/wp-content/uploads/assets/crs/R40667.pdf (describing digester types and basic operating parameters); Wendy J. Powers & Robert T. Burns, Energy and Nutrient Recovery from Swine Manures 1-3 (2007), *available at* http://www.pork.org/filelibrary/Energy%20and%20Nutrient%20Recovery%20from%20Swine%20Manures.PDF (listing superior efficiency and environmental benefits of digester technologies, compared to lagoons); Philip W. Westerman et al., *Struvite Crystallizer for Recovering Phosphorus from Lagoon and Digester Liquid* (2009), *available at* https://www.bae.ncsu.edu/extension/ext-publications/waste/animal/ag-724w-struvite-westerman.pdf (discussing successful application of "continuous-flow cone-shaped struvite crystallizer" to capture slow-release mineral fertilizer from swine lagoon effluent); Nathan O. Nelson et al., *Struvite Precipitation in Anaerobic Swine Lagoon Liquid: Effect of pH and Mg:P ratio and Determination of Rate Constant*, 89 Biores. Tech. 229, 230 (2003) (reporting success of laboratory batch experiments precipitating struvite from "[a]naerobic swine lagoon liquid . . . collected from two active farms in North Carolina").

[121] *See, e.g.*, Karl A. Shaffer & Sanjay Shah, NCSU Coop. Ext., SoilFacts: Reducing Drift and Odor with Wastewater Application 2 (2008), *available at* http://www.soil.ncsu.edu/publications/Soilfacts/AG439-69W.pdf; Ndegwa, *supra* note 118, at 455-56.

169. DENR has the authority to require improved monitoring, including groundwater monitoring, and reporting, which is critical in light of recent cutbacks in DENR personnel, to ensure that facilities are meeting standards.

VIII. RELIEF

As established above, DENR issued a General Permit that fundamentally fails to protect the health and environment of residents living in proximity to permitted swine facilities, disproportionately affecting African Americans, Latinos, and Native Americans. Despite years of documentation demonstrating how these facilities—and particularly the dense concentration of swine facilities in communities in the eastern portion of the state—have polluted the water and air and affected the daily life of area residents, DENR issued a permit that contains essentially the same conditions as the last permit. This is entirely unacceptable and contrary to federal law.

First, to obtain funds, DENR must offer EPA the assurance that it will not undertake any action that violates Title VI, but DENR issued the General Permit without conducting an analysis of the potential for disproportionate health and environmental impacts on the basis of race and national origin. Complainants request that OCR investigate DENR's failure to satisfy the prerequisites for obtaining EPA funding and require DENR to complete a disproportionality analysis of its permitting program. Complainants further request that EPA require that DENR, in any future consideration of a permit program for industrial animal production in the state, conduct a robust analysis of disproportionate impact on the basis of race and ethnicity, including cumulative impacts from other nearby facilities, to ensure compliance with Title VI and its regulations.

Second, Complainants request that OCR conduct an investigation to determine whether DENR also violated Title VI and EPA's implementing regulations by issuing the revised general permit for swine waste management system in light of its grossly inadequate protections for the health and environment of people living in proximity to swine facilities, a permit that will have a statistically significant disproportionate impact on African Americans, Latinos and Native Americans. The General Permit simply fails to include conditions to prevent these facilities from continuing to injure human health and pollute the water and air. Study after study has shown that permitted swine facilities using the lagoon and sprayfield system in ways that are allowed by the General Permit spew pollution on surrounding communities, degrading air and water quality, injuring human health, and impacting quality of life. People living in proximity to industrial swine facilities, and particularly to multiple operations, have switched from using well water for fear that their water is contaminated with swine waste. They have given up fishing and hunting because they worry about the effect of pollution on the environment and surface water quality. They have complained that the pollution and overwhelming odor from these facilities makes it difficult to breathe, aggravates their allergies, and contributes to respiratory problems. People living in the shadow of permitted swine facilities are careful to

avoid spending time outside when the smell from the facilities is at its worse. They fear that their property values have declined because of proximity to the odors and other effects of swine facilities. Moreover, these long documented adverse effects of DENR's permitting program disproportionately affect African Americans, Latinos, and Native Americans, and they cannot be justified. DENR has alternatives, but has refused to exercise its authority to protect communities who for years have been struggling with the adverse effects of industrial swine facilities.

Community members have long asked why their way of life has been assaulted day in and day out by feces and urine from this industry, why so many industrial swine facilities were allowed to locate, densely packed, on the low lying coastal plain of the state, where soils are sandy and shallow and cannot absorb the massive amounts of waste that the industry creates. As journalist Wendy Nicole wrote in an article appearing in 2013 in Environmental Health Perspectives:

> The clustering of North Carolina's hog CAFOs in low-income, minority communities – and the health impacts that accompany them – has raised concerns of environmental injustice and environmental racism. As one pair of investigators explained, "[P]eople of color and the poor living in rural communities lacking the political capacity to resist are said to shoulder the adverse socio-economic, environmental, or health related effects of swine waste externalities without sharing in the economic benefits brought by industrial pork production."[122]

Today, however, Complainants are focusing on what DENR can do – indeed, has the legal obligation to do -- to protect them, and ask EPA to require, at a minimum, that DENR revise the General Permit to condition the operation of facilities on protections, including the installation and operation of waste management systems to prevent pollution, improved monitoring, and public reporting, among other things, to bring DENR into compliance with Title VI and EPA's regulations. Should DENR fail to come into compliance voluntarily, Complainants request that EPA initiate proceedings to suspend or terminate EPA funding to DENR in accordance with Title VI and 40 C.F.R. §§ 7.115(e), 7.110(c), 7.130(b).

---

[122] Nicole, *supra* note 39 (quoting B. Edwards B & AE Ladd, *Race, Poverty, Political Capacity and the Spatial Distribution of Swine Waste in North Carolina*, 1982–1997, 9 North Carolina Geogr 55–77 (2001)).

Sincerely,

Dated: September 3, 2014

EARTHJUSTICE

By: _____

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Jocelyn D'Ambrosio

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On behalf of:
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Rural Empowerment Association for Community Help
(b) (6) - Privacy

Waterkeeper Alliance, Inc.
(b) (6) - Privacy

cc (via email)

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NC CAFO Coordinator
Waterkeeper Alliance, Inc.

(b) (6) - Privacy

(b) (5) Deliberative, (b) (7)(A) Enforcement

(b) (5) Deliberative, (b) (7)(A) Enforcement

(b) (5) Deliberative, (b) (7)(A) Enforcement

REACH Complaint Summarized

Complainants: 1) North Carolina Environmental Justice Network, 2) Rural Empowerment Association for Community Help ("REACH"), 3) Waterkeeper Alliance, represented by Earth Justice

Recipient: North Carolina Department of environment and Natural Resources (DENR). DENR awarded $19.3 million in federal funds in FY 2014; DENR is a department of the State of North Carolina

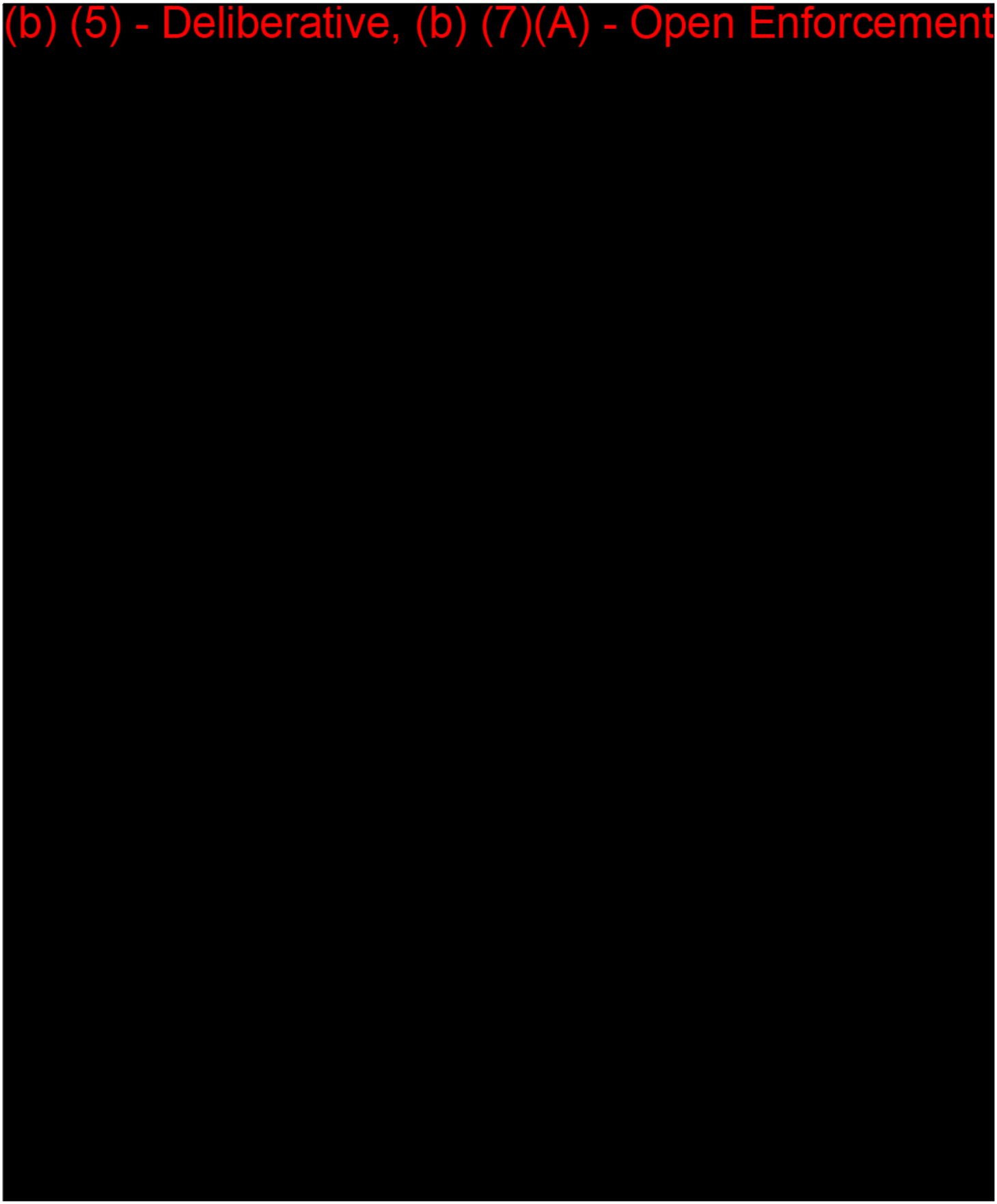
Accepted Allegation

1. Permit - DENR's decision to issue/renew Swine Waste Management System General Permit, AWG100000 on March 7, 2014, allowing industrial swine facilities in North Carolina to operate violates Title VI by failing to protect human health and the environment

    a. DENR began issuing general permits on January 1, 1997 and after legislature extended permits, finalization extended to September 30, 2014

(b) (5) - Deliberative, (b) (7)(A) - Open Enforcement

[redacted]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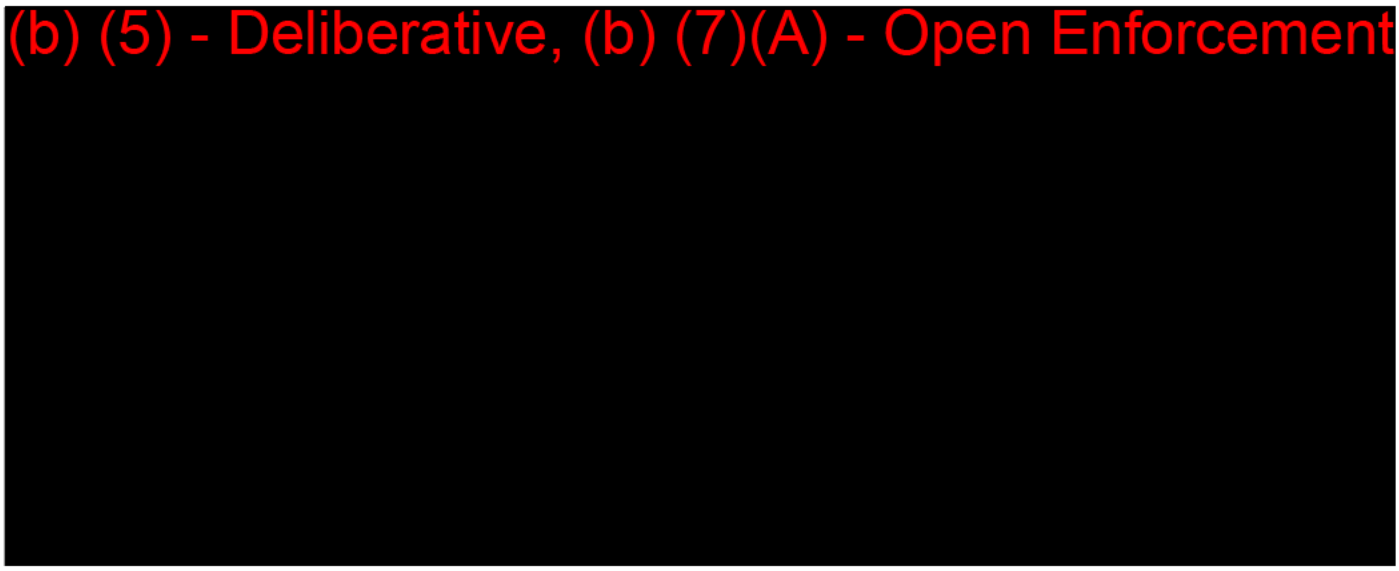
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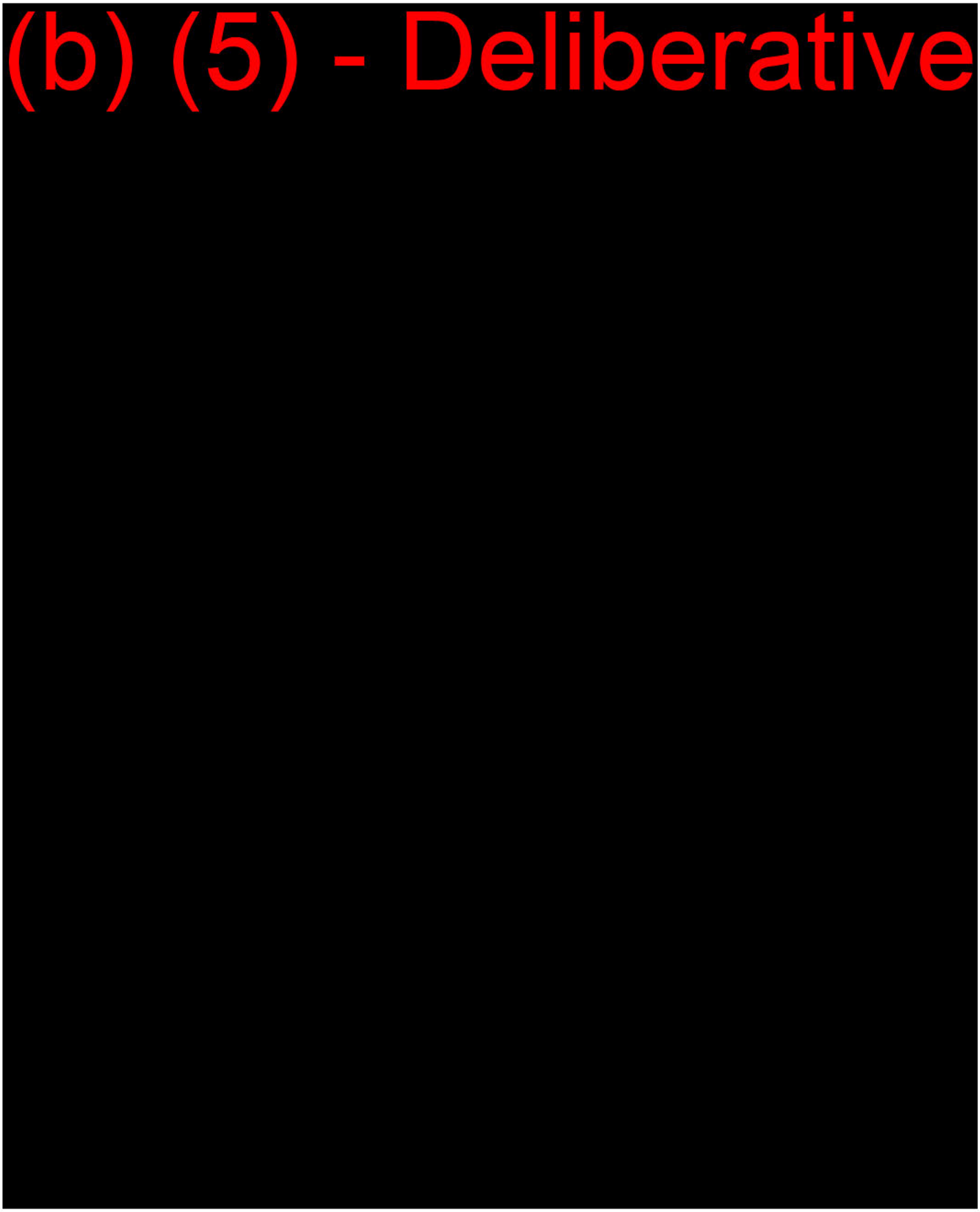
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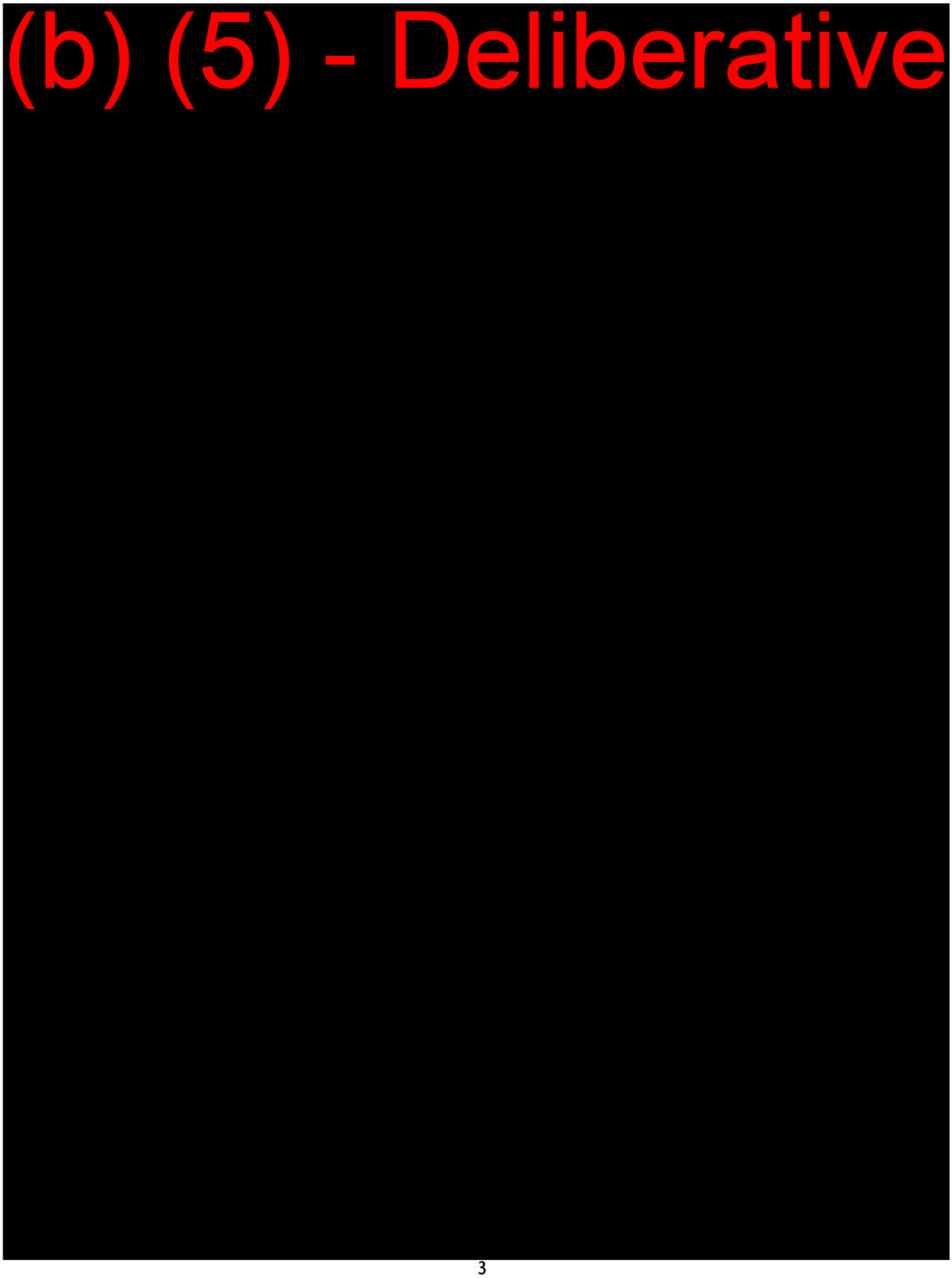
(b) (5) - Deliberative

Sincerely,

Helena Wooden-Aguilar
Assistant Director
External Compliance and Complaints Program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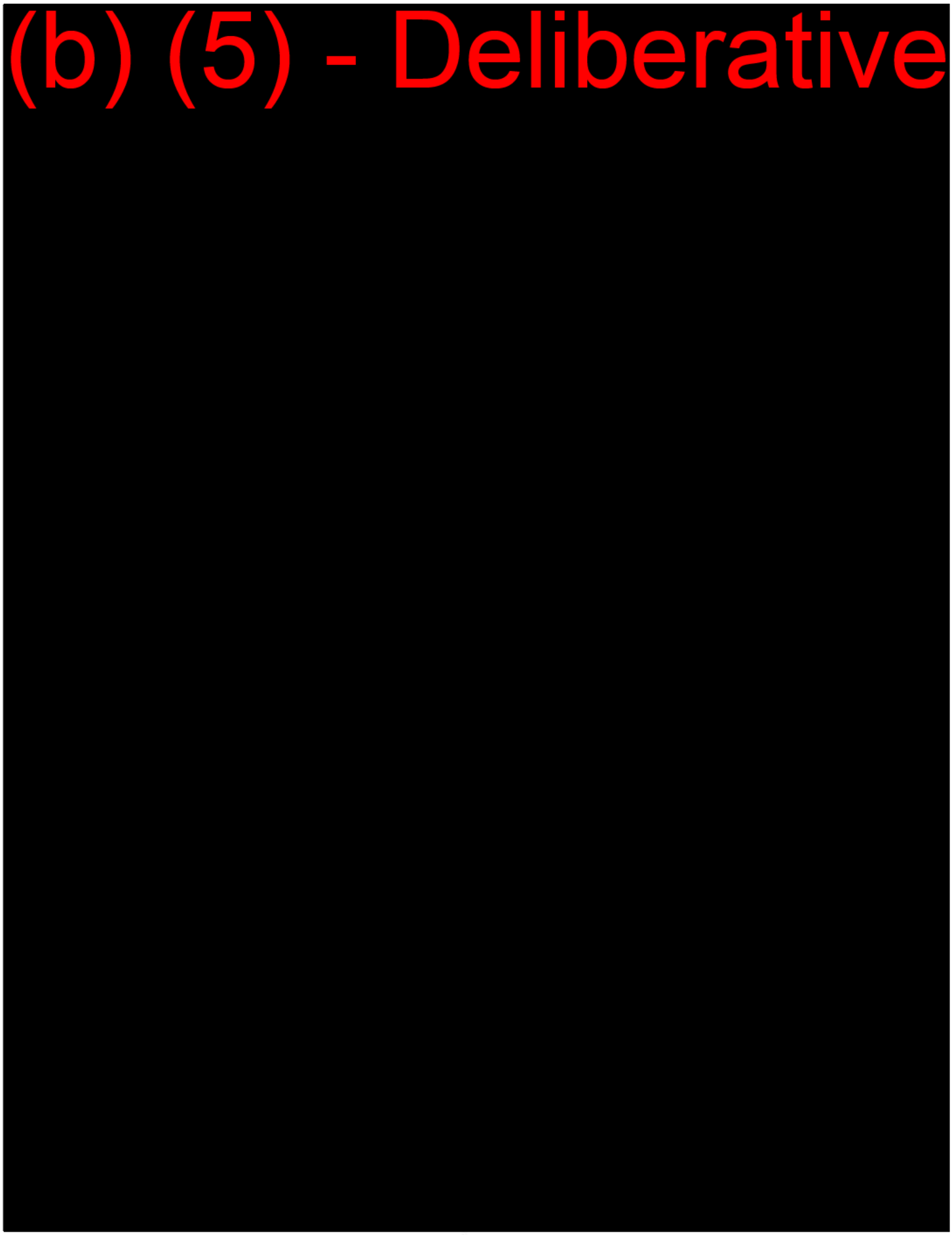
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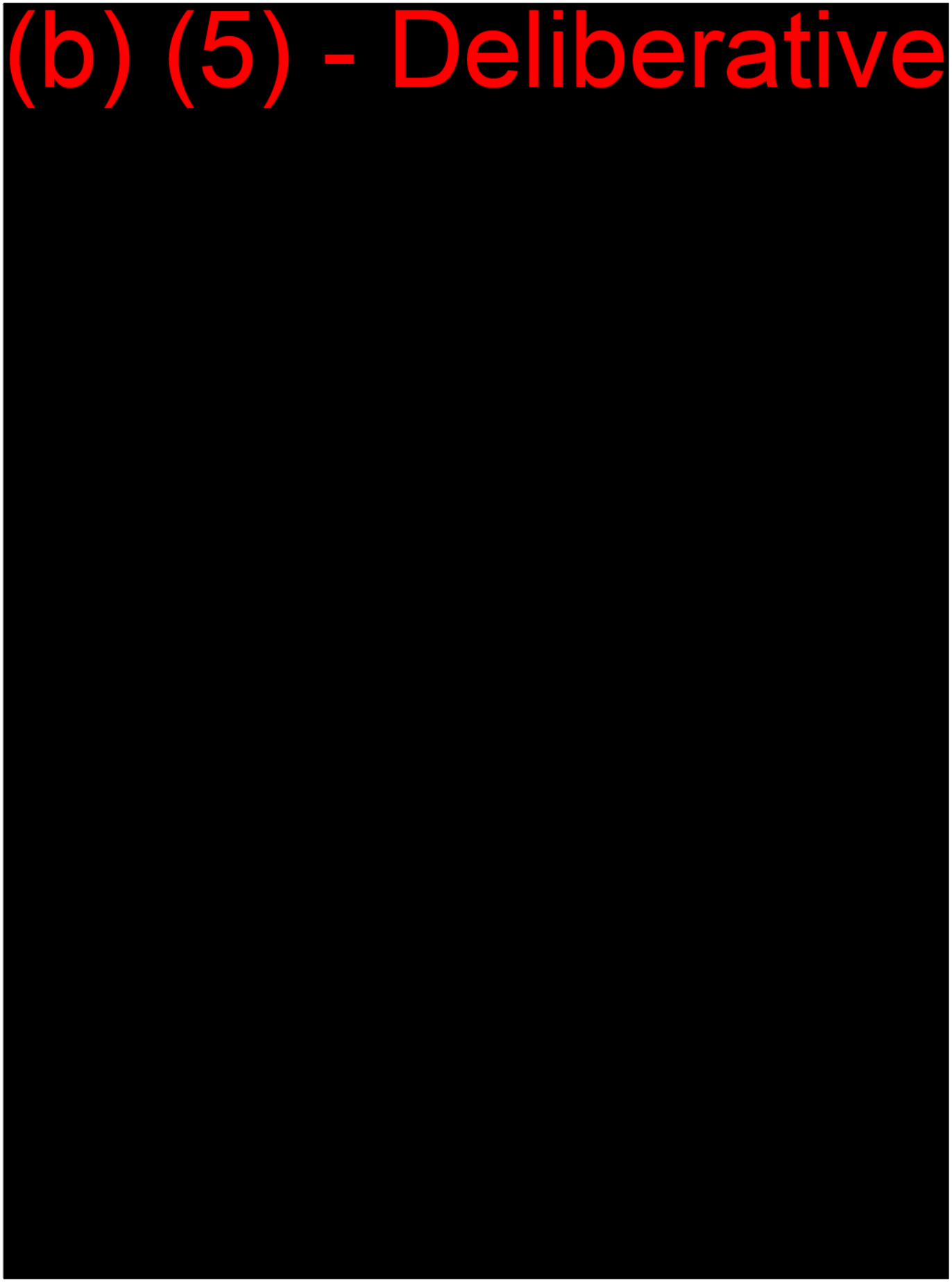
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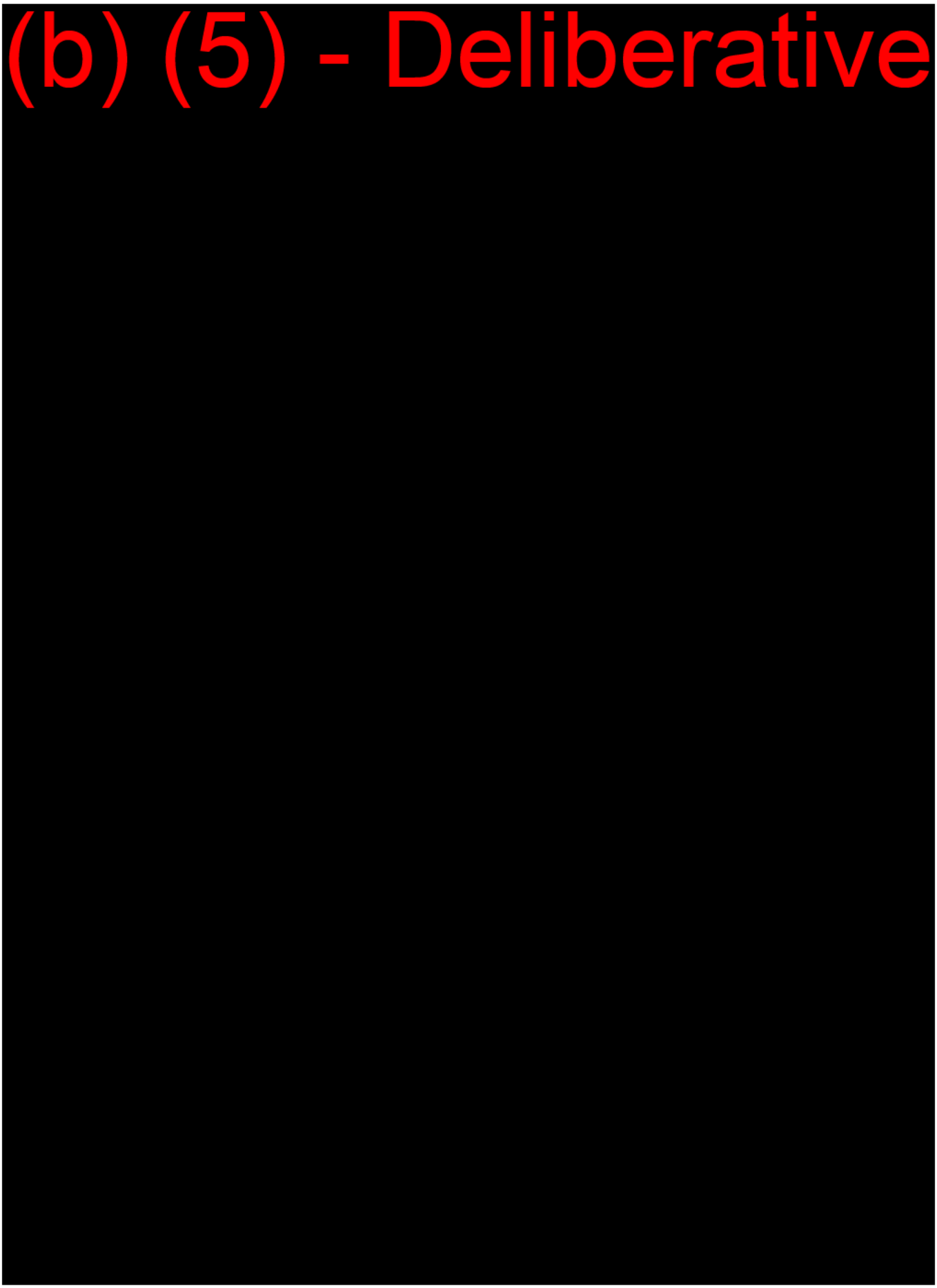
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PETITIONING EPA ON CIVIL RIGHTS VIOLATIONS

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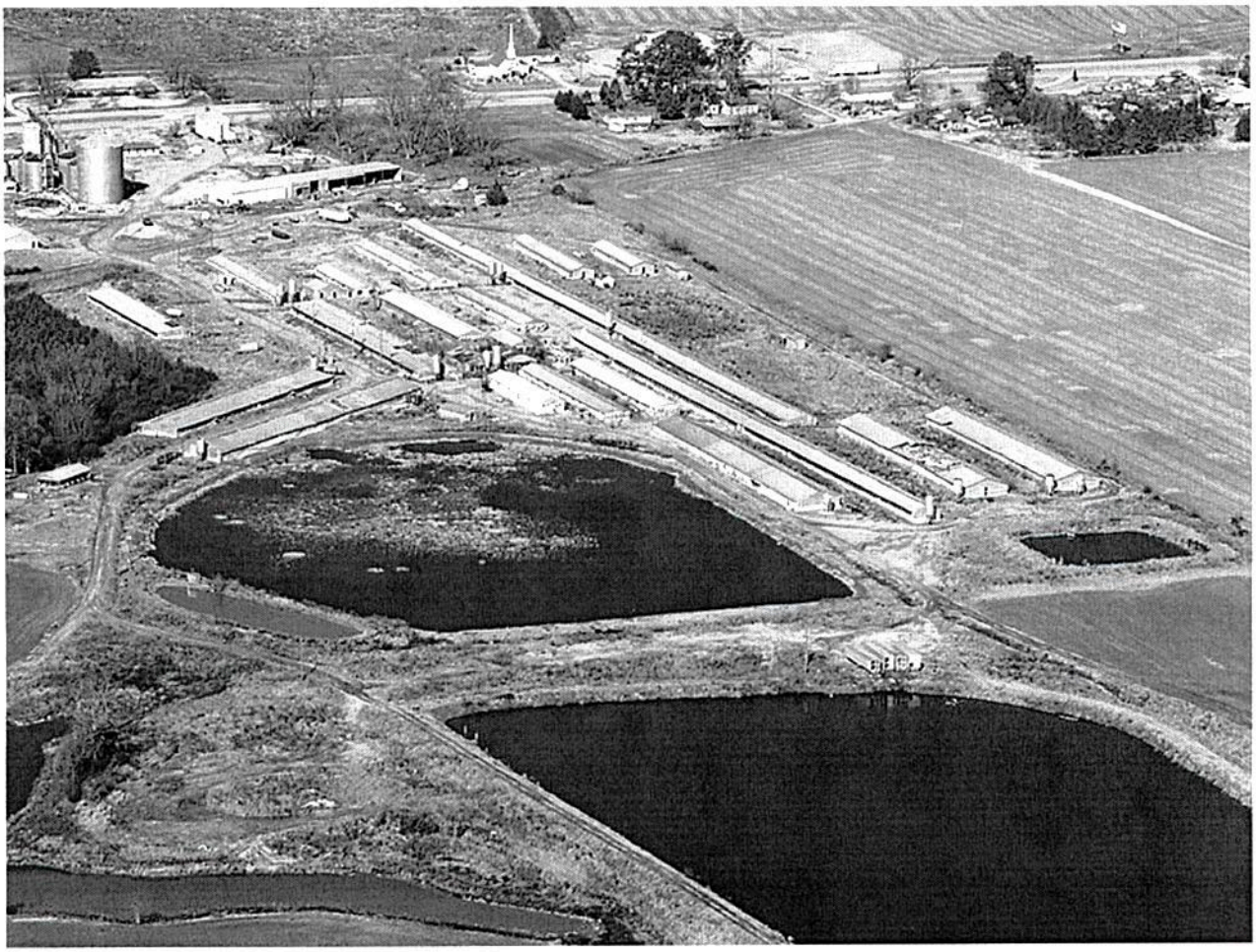

An industrial hog facility in North Carolina. Hog feces and urine are flushed into open, unlined pits and then sprayed onto nearby fields. The practice leads to waste contaminating nearby waters, and drifting as "mist" onto neighboring properties.

PHOTO COURTESY OF FRIENDS OF FAMILY FARMERS

WHAT'S AT STAKE

The industrial hog facilities are disproportionately located in communities of color, where residents are forced to endure the smell and water quality impacts.

CASE OVERVIEW

The North Carolina Environmental Justice Network, Rural Empowerment Association for Community Help and Waterkeeper Alliance, supported by Earthjustice, have filed a complaint with the Environmental Protection Agency (EPA) Office of Civil Rights under Title VI of the Civil Rights Act of 1964 alleging that North Carolina's lax regulation of hog waste disposal discriminates against communities of color in eastern North Carolina.

The complaint is the latest chapter in a longstanding struggle to address the community health impacts posed by massive amounts of fecal waste from industrial hog facilities. Community members have repeatedly asked the North Carolina Department of Environment and Natural Resources (DENR) for stronger protections, but are now seeking help from the EPA, stating that a recent decision by DENR to issue a permit that will cover thousands of hog facilities without adequate waste disposal controls violates federal law and civil rights.

The permit continues to allow industry to flush hog feces and urine into open, unlined pits and then to spray this "liquid manure" onto nearby fields. This practice leads to waste contaminating nearby waters. The waste also drifts as mist onto neighboring properties, causing unbearable odors. The impact is worsened by the growth of the poultry industry in the state and the piles of chicken waste that often sit uncovered on fields for days on end.

These operations are disproportionately located in communities of color where neighbors are forced to endure the smell, water quality impacts and the embarrassment associated with the facilities operating near their homes.

CASE ID
2382

REGIONAL OFFICE
Northeast

ATTORNEYS
Marianne Engelman Lado
Jocelyn D'Ambrosio

CLIENTS
North Carolina Environmental Justice Network
Rural Empowerment Association for Community Help
Waterkeeper Alliance

FOCUS AREA
Clean Water

> *Rural eastern North Carolinians, especially poor people and people of color, continue to suffer from the horrible conditions brought on by the industrial hog industry.*
>
> —Naeema Muhammad
> Director, North Carolina Environmental Justice Network

CASE UPDATES

February 25, 2015 / *Press Release*

EPA Launches Investigation of North Carolina for Civil Rights Violations

February 25, 2015 / *Letter*

EPA Notice of Acceptance of North Carolina Civil Rights Investigation

September 4, 2014 / *Press Release*

Community Groups Petition EPA for Precedent Setting Case on Civil Rights Violations

September 3, 2014 / *Legal Document*

North Carolina EJ Network et al. Complaint under Title VI

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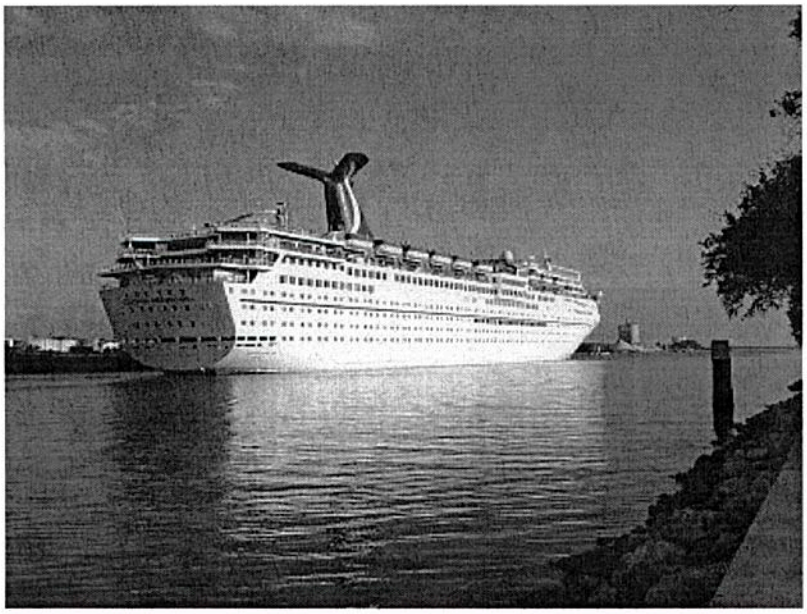

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EPA LAUNCHES INVESTIGATION OF NORTH CAROLINA FOR CIVIL RIGHTS VIOLATIONS

Groups allege State's lax regulation of hog operations has disproportionate impact on communities of color

2117

An industrial hog facility in North Carolina. Hog feces and urine are flushed into open, unlined pits and then sprayed onto nearby fields. The practice leads to waste contaminating nearby waters, and drifting as "mist" onto neighboring properties.

PHOTO COURTESY OF FRIENDS OF FAMILY FARMERS

> *For decades, North Carolina has known that practices for managing massive amounts of manure at industrial hog facilities are grossly inadequate.*
>
> —Marianne Engelman Lado
> Earthjustice's lead counsel on this case

February 25, 2015

Washington, D.C. — Late last week, the U.S. Environmental Protection Agency's Office of Civil Rights (OCR) announced that it has accepted a complaint filed against the North Carolina Department of Environment and Natural Resources (DENR) under Title VI of the Civil Rights Act, and will proceed with an investigation of the State agency.

In September, the North Carolina Environmental Justice Network, Rural Empowerment Association for Community Help and Waterkeeper Alliance, supported by Earthjustice, filed a complaint with the OCR alleging that North Carolina's lax regulation of hog waste disposal discriminates against communities of color in eastern North Carolina. The UNC Center for Civil Rights has joined as co-counsel with Earthjustice. The federal agency reviewed the complaint, and has now made the initial determination that an investigation is warranted.

The complaint is the latest chapter in a longstanding struggle to address the community health impacts posed by massive amounts of fecal waste from industrial hog facilities. Community members have repeatedly asked DENR for stronger protections, but are now seeking help from the EPA, stating that a recent decision by DENR to issue a permit that will cover thousands of hog

facilities without adequate waste disposal controls violates federal law and civil rights.

"For too long, DENR has failed to fulfill its obligation to protect citizens from the negative impacts of the hog industry," **said Larry Baldwin, Concentrated Animal Feeding Operations (CAFO) Coordinator at Waterkeeper Alliance.** "I am confident that the EPA investigation will find this to be true, and we look forward to having representatives come to eastern NC to see the impacts first-hand."

In January, a study published by researchers at the University of North Carolina and Johns Hopkins linked high levels of fecal bacteria in waterways to industrial hog operations. Researchers confirmed the source of the bacteria by testing for markers of bacteria that only come from pigs. In an interview with Environmental Health News, a spokesperson for DENR was dismissive of the study calling the results "inconclusive."

"People just can't ignore this. The air stinks, the water is contaminated and property values are depleted," **said Naeema Muhammad, Director of North Carolina Environmental Justice Network.** "We've been asking the state and our representatives for years to do something different about how this industry operates in the state of North Carolina. It was an insult to the community and to the people of the state of North Carolina to renew those permits."

The permit continues to allow industry to flush hog feces and urine into open, unlined pits and then to spray this "liquid manure" onto nearby fields. This practice leads to waste contaminating nearby waters. The waste also drifts as mist onto neighboring properties, causing unbearable odors. The impact is worsened by the growth of the poultry industry in the state and the piles of chicken waste that often sit uncovered on fields for days on end.

These operations are disproportionately located in communities of color where neighbors are forced to endure the smell, water quality impacts and the embarrassment associated with the facilities operating near their homes.

"We invited DENR to our Collaborative Problem-Solving workshops, which were funded by EPA, and even with that DENR has neglected to act on the

problems that exist in these impacted communities," **said Devon Hall, Project Manager at the Rural Empowerment Association for Community Help (REACH)**. "I am glad that EPA has agreed to investigate this matter so that the voices of the people can be heard."

"For decades North Carolina has known that practices for managing massive amounts of manure at industrial hog facilities are grossly inadequate," **said Marianne Engelman Lado, Earthjustice attorney and lead counsel on this case**. "Change is long overdue. We're hopeful that EPA's investigation will lead to the actions needed to protect the health of local communities."

Read the EPA Notice of Acceptance.

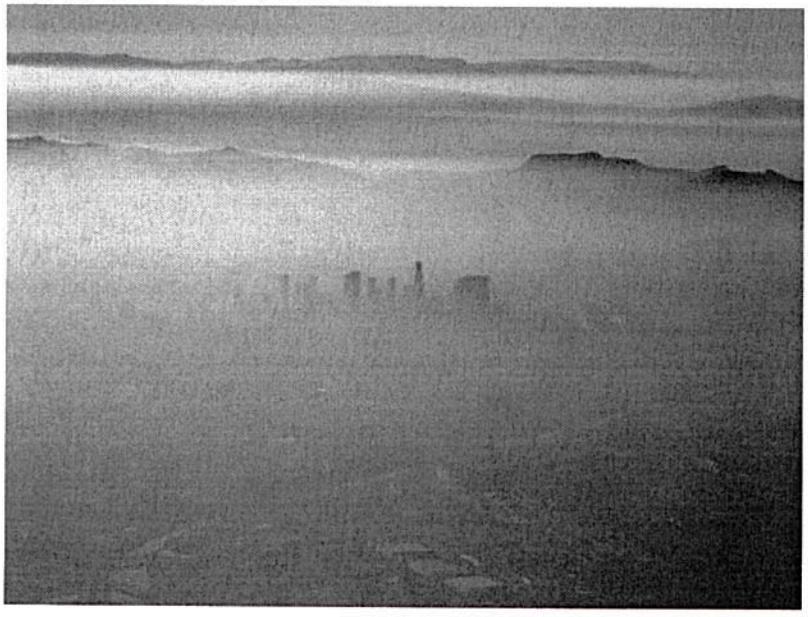
CONTACTS

Phillip Ellis, Earthjustice, (202) 320-2044

Legal Case

PETITIONING EPA ON CIVIL RIGHTS VIOLATIONS

TAKE ACTION



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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

February 20, 2015

Return Receipt Requested
Certified Mail#: 7006-3450-0003-3868-5424

In Reply Refer to:
EPA File No.: 11R-14-R4

Donald R. van der Vaart
Secretary
North Carolina Department of Environment and
Natural Resources
1611 Mail Service Center
Raleigh, NC 27699-1611

Re: Notification of Acceptance of Administrative Complaint

Dear Secretary van der Vaart,

This letter is to notify you that the U.S. Environmental Protection Agency (EPA), Office of Civil Rights (OCR), is accepting an administrative complaint, 11R-14-R4, filed against the North Carolina Department of Environment and Natural Resources (DENR) dated September 3, 2014. The complaint generally alleges that DENR violated Title VI of the Civil Rights Act of 1964, as amended, 42 United States Code 2000d *et seq.*, and the EPA's nondiscrimination regulations found at 40 Code of Federal Regulations (C.F.R.) Part 7.

Pursuant to the EPA's nondiscrimination regulations, OCR conducts a preliminary review of administrative complaints for acceptance, rejection, or referral to the appropriate agency. *See* 40 C.F.R. §7.120(d)(1). OCR accepts for investigation complaints that meet the four jurisdictional requirements described in the EPA's nondiscrimination regulations. First, the complaint must be in writing. *See* 40 C.F.R. §7.120(b)(1). Second, the complaint must describe an alleged discriminatory act that, if true, may violate the EPA's nondiscrimination regulations (*e.g.*, an alleged discriminatory act based on race, color, national origin, sex, age, or disability). *Id.* Third, the complaint must be filed within 180 calendar days of the alleged act. *See* 40 C.F.R. §7.120(b)(2). Finally, the complaint must be against an applicant for, or a recipient of, EPA financial assistance that allegedly committed the discriminatory act. *See* 40 C.F.R. §7.15.

After careful consideration, the EPA is accepting the following allegation for investigation:

(b) (5) - Deliberative

This allegation is accepted for investigation because it meets the EPA's four jurisdictional requirements. First, the complaint is in writing. Second, the complaint describes an alleged discriminatory act that may violate the EPA's nondiscrimination regulations. Third, the alleged discriminatory act occurred within 180 days of the filing of the complaint. And finally, the complaint was filed against North Carolina DENR, an applicant for, or recipient of, EPA financial assistance. This acceptance in no way amounts to a decision on the merits. EPA will begin its process to gather the relevant information, discuss the matter further with you and your designees and determine next steps utilizing its internal procedures. As a part of OCR's established investigative process, you will receive a request for information from OCR in the near future. In the intervening time, please feel free to provide OCR with any information that you believe will assist EPA in this matter.

OCR would like to notify you that the complaint raises another allegation related to NC DENR's failure to enforce its regulatory and/or statutory requirements for swine farms. However, the complaint did not provide enough information for OCR to complete its jurisdictional review. As a part of OCR's established jurisdictional review process, OCR has requested the Complainants provide the necessary information within twenty (20) days of their receipt of the enclosed letter. If this information is not provided within this period, OCR will not accept the allegation for investigation.

The EPA's nondiscrimination regulations provide that OCR will attempt to resolve complaints informally whenever possible. 40 C.F.R. §7.120(d)(2). Accordingly, OCR is willing to discuss, at any point during the process, offers to informally resolve the complaint, and may, to the extent appropriate, facilitate an informal resolution process with the involvement of affected stakeholders, including alternative dispute resolution (ADR) as described at http://www.epa.gov\civilrights\faq-adrt6.htm. We will be contacting both the Complainants' representative and your designated representative in the near future to discuss potential interest in pursuing ADR. Please provide OCR with the name and contact information of your designated representative at your earliest convenience.

If you have any other questions, please do not hesitate to contact Helena Wooden-Aguilar, Assistant Director, External Civil Rights Program at (202) 564-0792, by e-mail at wooden-aguilar.helena@epa.gov, or U.S. mail at U.S. EPA, Office of Civil Rights, (Mail Code 1201A), 1200 Pennsylvania Avenue, N.W., Washington, D.C. 20460-1000.

Sincerely,

Velveta Golightly-Howell
Director

February 20, 2015

Return Receipt Requested
Certified Mail#: 7006-3450-0003-3868-5417

In Reply Refer to:
EPA File No. 11R-14-R4

Marianne Engleman Lado
and Jocelyn D'Ambrosio
Earthjustice
48 Wall Street, 19th Floor
New York, New York 10005

Re: Notification of Acceptance of Administrative Complaint

Dear Ms. Lado and Ms. D'Ambrosio:

This letter is to notify you that the U.S. Environmental Protection Agency (EPA), Office of Civil Rights (OCR), is accepting your September 3, 2014, administrative complaint, 11R-14-R4, filed against the North Carolina Department of Environment and Natural Resources (DENR). The complaint generally alleges that DENR violated Title VI of the Civil Rights Act of 1964, as amended, 42 United States Code 2000d *et seq.*, and the EPA's nondiscrimination regulations found at 40 Code of Federal Regulations (C.F.R.) Part 7.

Pursuant to the EPA's nondiscrimination regulations, OCR conducts a preliminary review of administrative complaints for acceptance, rejection, or referral to the appropriate agency. *See* 40 C.F.R. §7.120(d)(1). OCR accepts for investigation complaints that meet the four jurisdictional requirements described in the EPA's nondiscrimination regulations. First, the complaint must be in writing. *See* 40 C.F.R. §7.120(b)(1). Second, the complaint must describe an alleged discriminatory act that, if true, may violate the EPA's nondiscrimination regulations (*e.g.*, an alleged discriminatory act based on race, color, national origin, sex, age, or disability). *Id.* Third, the complaint must be filed within 180 calendar days of the alleged act. *See* 40 C.F.R. §7.120(b)(2). Finally, the complaint must be against an applicant for, or a recipient of, EPA financial assistance that allegedly committed the discriminatory act. *See* 40 C.F.R. §7.15.

After careful consideration, the EPA is accepting the following allegation for investigation:

- North Carolina DENR's regulation of swine feeding operations discriminates against African Americans, Latinos, and Native Americans on the basis of race and national origin in neighboring counties and violates Title VI and EPA's implementing regulations.

This allegation is accepted for investigation because it meets the EPA's four jurisdictional requirements. First, the complaint is in writing. Second, the complaint describes an alleged discriminatory act that may violate the EPA's nondiscrimination regulations. Third, the alleged discriminatory act occurred within 180 days of the filing of the complaint. And finally, the complaint was filed against North Carolina DENR, an applicant for, or recipient of, EPA financial assistance. This acceptance in no way amounts to a decision on the merits. EPA will begin its process to gather the relevant information, discuss the matter further with the recipients and determine next steps utilizing its internal procedures.

(b) (5) - Deliberative

If you have any questions about the information that OCR is requesting, please feel free to contact Helena Wooden-Aguilar, Assistant Director, External Civil Rights Program at (202) 564-0792, by e-mail at wooden-aguilar.helena@epa.gov, or U.S. mail at U.S. EPA, Office of Civil Rights, (Mail Code 1201A), 1200 Pennsylvania Avenue, N.W., Washington, D.C. 20460-1000.

The EPA's nondiscrimination regulations provide that OCR will attempt to resolve complaints informally whenever possible. 40 C.F.R. §7.120(d)(2). Accordingly, OCR is willing to discuss, at any point during the process, offers to informally resolve the complaint, and may, to the extent appropriate, facilitate an informal resolution process with the involvement of affected stakeholders, including alternative dispute resolution (ADR) as described at http://www.epa.gov\civilrights\faq-adrt6.htm. We will be contacting both you and representatives of North Carolina DENR in the near future to discuss your potential interest in pursuing ADR.

If you have any other questions, please do not hesitate to contact us.

Sincerely,

Velveta Golightly-Howell
Director

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 12 2014

Return Receipt Requested
Certified Mail#: 7004-1160-0002-3622-9056

In Reply Refer to:
EPA File No. 11R-14-R4

Marianne Engleman Lado
and Jocelyn D'Ambrosio
Earthjustice
48 Wall Street, 19th Floor
New York, NY 10005-2967

Re: Notification of Receipt of Administrative Complaint

Dear Ms. Lado and Ms. D'Ambrosio:

This is to notify you that the U.S. Environmental Protection Agency (EPA), Office of Civil Rights (OCR), received your complaint on September 4, 2014. Your correspondence alleges that the North Carolina Department of Environment and Natural Resources violated Title VI of the Civil Rights Act of 1964, 42 U.S.C. §§ 2000d to 2000d-7, and the United States Environmental Protection Agency's implementing regulations, 40 C.F.R. Part 7.

OCR is responsible for processing and investigating complaints alleging discrimination by programs or activities that receive financial assistance from EPA. Pursuant to EPA's nondiscrimination regulations, OCR reviews the complaint for acceptance, rejection, or referral to another Federal agency. 40 C.F.R. §7.120(d)(1). Once this jurisdictional review is complete, OCR will notify you about its decision.

If your complaint is accepted for investigation, it may become necessary for OCR to reveal your identity to the entities listed above. Please read the enclosed consent/ release form, as well as the information about your rights and protections. Please complete the consent/release form and return the form to the address below within ten (10) calendar days after your receipt of this letter.

EPA's nondiscrimination regulations also provide that OCR must attempt to resolve complaints informally whenever possible (40 C.F.R. §7.120(d)(2). Accordingly, if your complaint is accepted for investigation, OCR may discuss offers to informally resolve the complaint, and may, to the extent appropriate, facilitate an informal resolution process with the involvement of affected stakeholders.

In the interim, if you have any questions about the status of this complaint, please contact Ericka Farrell of my staff at (202) 564-0717 or via e-mail at farrell.ericka@epa.gov.

Sincerely,

Helena Wooden-Aguilar
Acting Deputy Director
Office of Civil Rights

Enclosures

cc: Kevin Redden, Assistant General Counsel
Civil Rights & Finance Law Office (MC 2399A)

Ken LaPierre, Deputy Civil Rights Official
EPA Region IV

Naima Halim-Chestnut, EEO Officer
EPA Region IV

Beverly Banister, Title VI Contact
EPA Region IV

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Article

CALPUFF and CAFOs: Air Pollution Modeling and Environmental Justice Analysis in the North Carolina Hog Industry

Yelena Ogneva-Himmelberger *, Liyao Huang and Hao Xin

Department of International Development, Community and Environment, Clark University, 950 Main St., Worcester, MA 01610, USA; E-Mails: hlyao1108@gmail.com (L.H.); greenxinhao@gmail.com (H.X.)

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Academic Editors: Fazlay S. Faruque and Wolfgang Kainz

Received: 23 June 2014 / Accepted: 9 January 2015 / Published: 26 January 2015

Abstract: Concentrated animal feeding operations (CAFOs) produce large amounts of animal waste, which potentially pollutes air, soil and water and affects human health if not appropriately managed. This study uses meteorological and CAFO data and applies an air pollution dispersion model (CALPUFF) to estimate ammonia concentrations at locations downwind of hog CAFOs and to evaluate the disproportionate exposure of children, elderly, whites and minorities to the pollutant. Ammonia is one of the gases emitted by swine CAFOs and could affect human health. Local indicator of spatial autocorrelation (LISA) analysis uses census block demographic data to identify hot spots where both ammonia concentrations and the number of exposed vulnerable population are high. We limit our analysis to one watershed in North Carolina and compare environmental justice issues between 2000 and 2010. Our results show that the average ammonia concentrations in hot spots for 2000 and 2010 were 2.5–3-times higher than the average concentration in the entire watershed. The number of people living in the areas where ammonia concentrations exceeded the minimal risk level was 3647 people in 2000 and 3360 people in 2010. We recommend using air pollution dispersion models in future environmental justice studies to assess the impacts of the CAFOs and to address concerns regarding the health and quality of life of vulnerable populations.

Keywords: exposure to air pollutants; CALPUFF; ammonia; CAFO; environmental justice; hog industry

1. Introduction

Livestock farming has experienced significant changes in the last few decades: while the number of small, family-owned animal farms has been decreasing, the number of large, industrial animal farms has been increasing, similar to consolidation in other commercial operations, such as grocery and clothing stores. According to the National Agricultural Statistics Service, 86% of all hogs raised in the U.S. in 2010 were concentrated in just 12% of hog operations [1]. Proponents of industrial agriculture argue that concentrated animal feeding operations (CAFOs) provide a "low-cost source of meat, milk, and eggs, due to efficient feeding and housing of animals, increased facility size, and animal specialization" and "enhance the local economy and increase employment" [2]. However, numerous studies conducted in the last 15 years have shown that the rapid growth of CAFOs brought about a series of negative environmental and human health effects [3–6]. The main source of air and water pollution is animal manure. Manure contains a variety of nutrients and potential contaminants, such as nitrogen, phosphorous, pathogens (e.g., *E. coli*), growth hormones, antibiotics, animal blood and chemicals used to clean the equipment [2]. According to some estimates, livestock animals produce three- to 20-times more manure than people in the U.S. [7], and a hog farm with 1,000 animals produces 14,500 tons of manure each year [8]. It is channeled from animal houses into pits or storage lagoons and eventually sprayed untreated onto nearby fields, replacing commercial fertilizers. Regulations require that manure storage units be designed to not leak into the groundwater (using concrete, clay soil lining or a metal structures). In addition, units must not discharge to surface waters and must be inspected by state and, sometimes, federal regulatory agencies.

Manure storage facilities on livestock farms produce gaseous (ammonia, hydrogen sulfide, methane) and particulate substances proportionate to the number or mass of animals housed. Ammonia is formed during microbial decomposition of undigested organic nitrogen compounds in manure; hydrogen sulfide is produced during anaerobic bacterial decomposition of sulfur-containing organic matter; and methane is created during anaerobic microbial degradation of organic matter. Both ammonia and hydrogen sulfide pose serious risks to human health at elevated concentrations, and methane contributes to climate change. Ammonia irritates the respiratory tract and causes severe coughing, chronic lung disease and chemical burns to the respiratory tract, skin and eyes [2]. Hydrogen sulfide causes inflammation of the membranes of the eye and respiratory tract, as well as loss of smell [2].

A recent research found that odors produced by the CAFOs also have adverse effects on health and quality of life [9]. The odors contain a mixture of ammonia, hydrogen sulfide, carbon dioxide and volatile and semi-volatile organic compounds [6] and, according to a report [2], under certain atmospheric conditions (with wind and little or no thermal gradient), can be detected as far as three miles away, sometimes up to six miles away. Several studies have shown that intolerable odors prevent residents from opening windows, spending time outdoors or inviting visitors, causing tension, depression, anger and anxiety about deteriorating quality of life [10–13]. Other reports note that the growth of CAFOs has forced small family farms out of business and altered local economies and communities [14,15].

North Carolina experienced rapid changes in the livestock industry starting in the 1970s and now is the second largest state (after Iowa) in hog herd size, with 9–10 million animals [9]. Most hog CAFOs are located in the eastern counties of the state. Multiple incidences of swine lagoon overflows and water pollution caused by hurricanes in the 1990s led to public protests, and the state placed a moratorium of new hog farms housing more than 250 hogs. Despite this 10-year moratorium (1997–2007) [16], the number of hogs in the state "quadrupled between 1988 and 2010, while the number of farms fell by more than 80 percent" (http://www.factoryfarmmap.org/).

Several survey-based studies analyzed the health conditions of the residents [5,17,18]; other studies documented disproportional exposure of low-income, minority communities in North Carolina to CAFOs [15,16,19–22]. Disproportional exposure to environmental pollution is an environmental justice issue. EPA defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (http://www.epa.gov/environmentaljustice/). All environmental justice studies related to CAFOs in North Carolina were conducted for the entire state and used the characteristics of CAFOs to represent potential pollution exposure. These studies used census-based units of analysis (county, census tract or block group) and socio-economic data from the census as analytical variables. Wing *et al.* (2000) used Poisson regression and the number of swine operations in the census block group as the dependent variable and the socio-economic characteristics of the block group as independent variables. They found that areas with the highest poverty and the highest percentage of minorities have the highest number of hog CAFOs per block group [17]. Wing *et al.* (2002) calculated ratios of the proportion of blacks to the proportion of whites living in areas with CAFOs that could be potentially flooded *vs.* areas not likely to be flooded [22]. They found that blacks were more likely than whites to live in areas with CAFOs that could be potentially flooded. Edward and Ladd used hog population per county as the dependent variable and county socio-demographics as independent variables [20] and found that minority communities are disproportionately exposed to high hog populations and that the relationship between income and hog population varies by region. A more recent study in eastern North Carolina [16] compared demographics of census tracts within one and three miles of CAFOs in 1990 and 2000 to random points within the same region. The results of this study showed that areas near CAFOs have higher percentages of minorities, low-income and low education level residents.

One of the limitations of these studies is that CAFO characteristics (the number of facilities or the number of hogs) are used as a surrogate measure of potential pollution produced by CAFOs. Our study tries to address this gap in the literature and uses modeled pollutant concentrations in the air as a measure of population exposure. We also use the smallest census-based unit of analysis, the census block, to analyze environmental justice at a finer spatial scale than previous studies. We limit our analysis to one watershed in eastern North Carolina and use longitudinal analysis to compare environmental justice issues between 2000 and 2010 in the context of ammonia pollution exposure. We chose ammonia because it is one of the most prevalent gases emitted by swine CAFOs.

None of the previous environmental justice studies in this area have analyzed the disproportionate exposure of children and the elderly. Children take in 20%–50% more air than adults and therefore are more susceptible to the health effects of air pollution [23]. Elderly people are more susceptible to air pollution due to ageing [24] and because air pollution can aggravate existing health conditions [25]. We include these populations in our analysis. Specifically, our study tries to answer the following question:

Are children, the elderly, white and minority populations disproportionately exposed to ammonia emitted by CAFOs in Contentnea Creek Watershed in North Carolina?

2. Study Area

Stretching across nearly 275 miles, the Neuse River is the longest river entirely contained in North Carolina. In 1995, 1996 and 1997, it was continuously designated as one of North America's most threatened rivers, and in 2007, it was designated as one of the most endangered rivers in the U.S. [26]. CAFO pollution was named one of the leading causes of the river's continuing pollution problems [26]. There are approximately 500 CAFO facilities housing about 1.8 million animals in the Neuse River Watershed [27].

Our study is focused on the Contentnea Creek Watershed (4274.85 km^2), a sub-basin of the Neuse River. The watershed contains several counties (Figure 1) and has one of the highest concentrations of CAFO facilities in North Carolina.

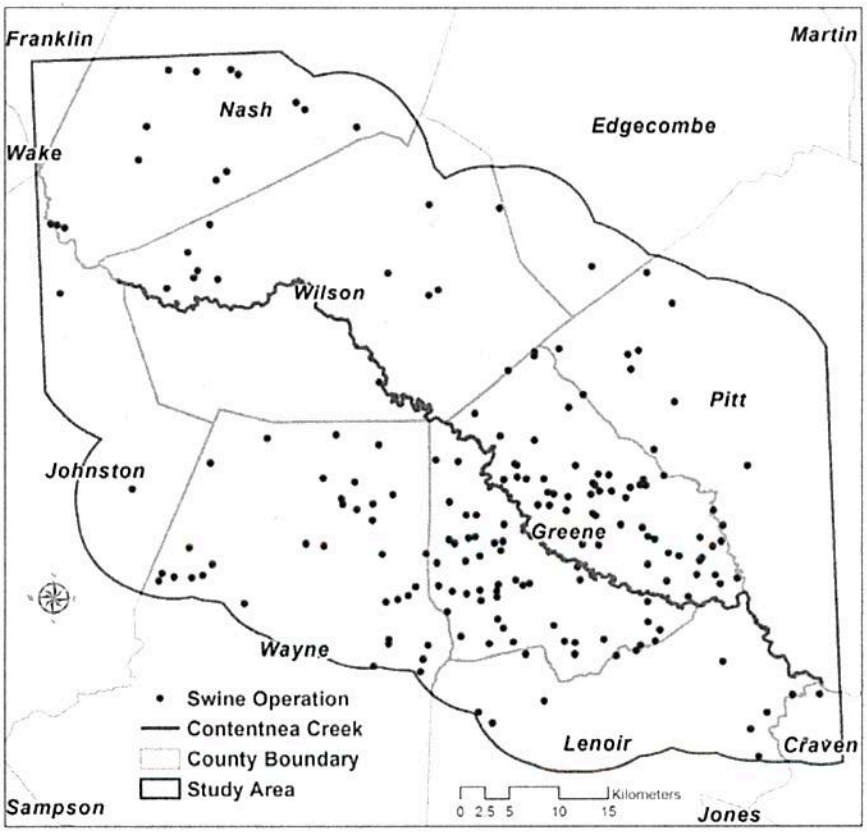

Figure 1. Study area with swine CAFO operations.

Pork production historically has been an important part of agriculture in this part of North Carolina, but it experienced an exponential growth in the 1990s. Population characteristics within this watershed are similar to the population in North Carolina as a whole: both have about a 32% minority population, about 20% of population below 15 years of age and about 13% of population over 65 years of age [28].

3. Data

Animal operations data were downloaded online from the NC Department of Environment and Natural Resources (NC DENR) Division of Water Quality website for 2010 (http://portal.ncdenr.org/web/wq/animal-facility-map). The data include the type of animal operation (swine, cattle, poultry and horse), capacity, geographic coordinates, total animal weight in kg and the description of each operation. Latitude/longitude information was used to map 195 swine CAFOs located in our study area (Figure 1).

Our goal was to use a spatial unit of analysis that would allow us to take full advantage of the spatial resolution of the ammonia concentration data (1 km × 1 km pixels) and detailed demographic information; the census block was the best option. We downloaded census block data from the U.S. Census Bureau website for the entire state (census block boundaries, age and racial composition) for 2000 and 2010. Poverty or income data were not included in the analysis, because these data are not publicly available at the census block level.

Both CAFO and census data were projected into the NAD 1983 State Plane North Carolina coordinate system. Census blocks located inside Contentnea Creek Watershed and within five miles outside its boundary were selected for the analysis. Census blocks within urban areas were removed from the analysis because CAFOs are located in rural areas. Boundaries of urban areas were obtained from the Census Bureau (http://www.Census.gov/geo/maps-data/data/cbf/cbf_ua.html). Uninhabited census blocks were excluded, because our focus was on human exposure to air pollution. The final dataset included 3290 census blocks for 2000 and 3685 census blocks for 2010. The number of blocks is different between the two years, because some census boundaries had changed.

Using 2000 and 2010 U.S. Census data, we calculated the number of people aged 65 and older, the number of people aged 15 and younger and the number of white and minority people. Table 1 shows the demographic data, and Figure 2 shows their spatial distribution. We used the actual number of people within each population group in the environmental justice analysis (instead of percent per census block), because it is a more relevant measure in the context of human exposure to air pollution.

Table 1. Demographic characteristics of census blocks in 2000 and 2010.

Year (# of Census Blocks)	*Statistics per Census Block*	*# of People under 15 Years of Age*	*# of People over 65 Years of Age*	*# of Minority Population*	*# White Population*
2000 (*3290*)	Min	0	0	0	0
	Max	263	93	815	348
	Mean	8	4	12	28
	Median	4	3	3	15
	SD	13	6	29	38
2010 (*3685*)	Min	0	0	0	0
	Max	263	149	725	482
	Mean	8	5	13	28
	Median	4	3	4	15
	SD	14	7	31	40

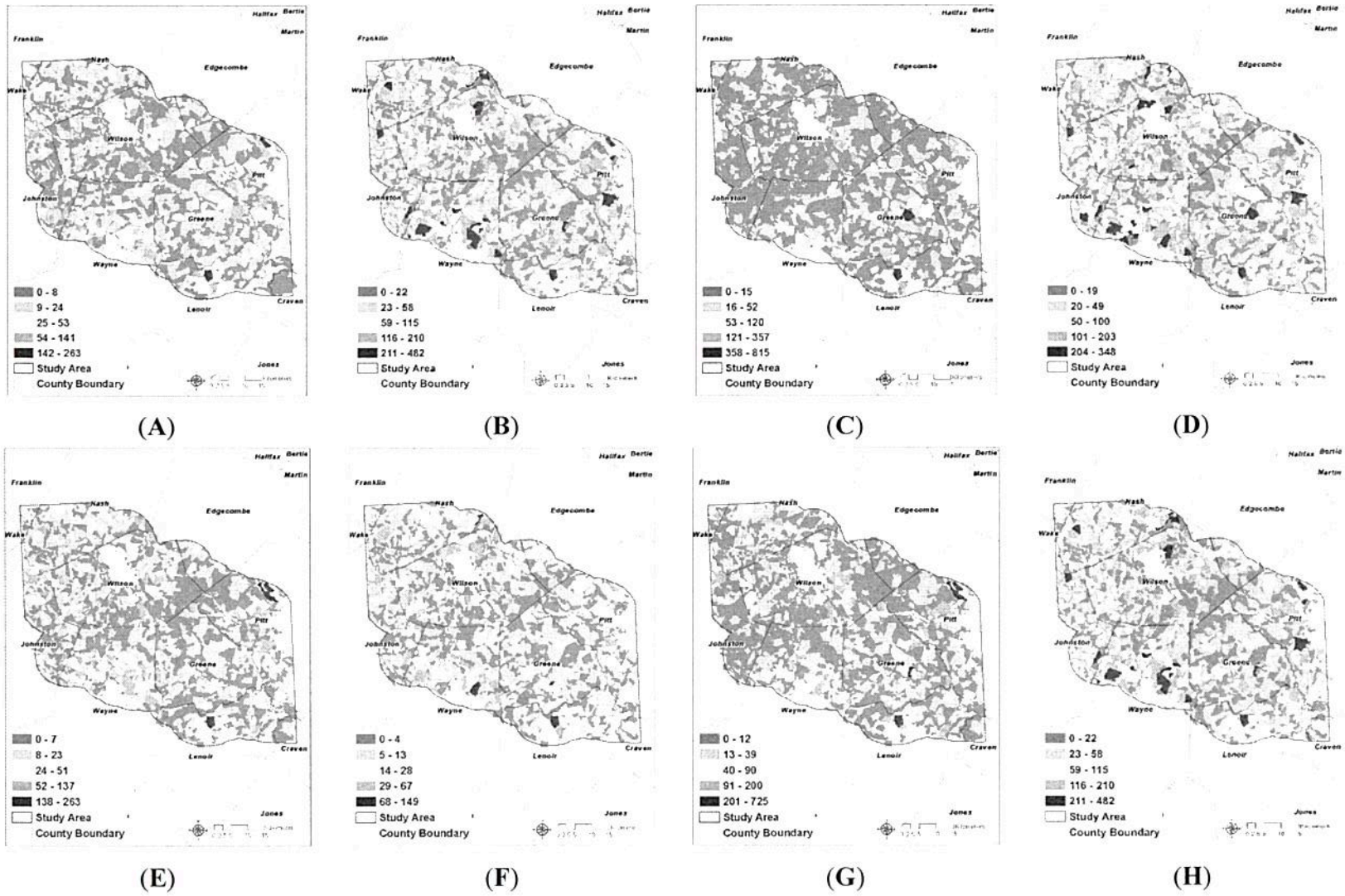

Figure 2. Demographic variables from 2000 and 2010 Census: (**A**) population of children under 15 in 2000; (**B**) population of elderly over 65 in 2000; (**C**) population of minorities in 2000; (**D**) population of whites in 2000; (**E**) population of children under 15 in 2010; (**F**) population of elderly over 65 in 2010; (**G**) population of minorities in 2010; (**H**) population of whites in 2010.

4. Methodology

4.1. Modeling Ammonia Concentrations

Air dispersion models have been used to estimate concentrations of pollutants emitted by CAFOs. Some studies modeled the dispersion of odor to define setback distances between CAFOs and residential areas [29]. Other studies attempted to model ammonia and hydrogen sulfide near CAFOs [30,31]. One study used the Industrial Source Complex Short-Term Model, version 3 (ISC-ST3), to model ammonia dispersion and deposition from CAFOs in North Carolina by hydrologic unit and county [30]. This model operates under the assumption that the concentration of the contaminant is defined by a normal, or Gaussian, curve and has some known deficiencies; it does not operate well during stable or near-calm conditions, and it cannot account for the effects of vegetation on concentrations, the effect of elevation nor wind distribution [29].

Another study used the CALPUFF model to model ammonia and hydrogen sulfide emitted by CAFOs in Minnesota [31]. The CALPUFF model accounts for variable wind directions and land cover pattern, includes a calm-wind algorithm and can model dispersion from multiple facilities and over a complex terrain. Due to these advantages, the "U.S. EPA has adopted CALPUFF as the preferred model for assessing long-range transport of pollutants" [29,32].

Following the U.S. EPA's recommendation [29,32], we selected CALPUFF to model ammonia dispersion in our study. The CALPUFF Modeling System includes three main components: CALMET, CALPUFF and CALPOST. CALMET is a meteorological model that develops wind and temperature models as three-dimensional grids. CALPUFF is a transport and dispersion model that emits "puffs" of material from modeled sources, simulating dispersion and transformation processes along the way. It uses the information generated by CALMET, and temporal and spatial variations in the meteorological grids are explicitly incorporated with the resulting distribution of puffs throughout a simulated period. The output files from CALPUFF contain concentrations evaluated at selected locations, called receptors. CALPOST is used to process these files and produce the summarized results of the simulation [33].

Three main types of data are required to run the model: hourly average meteorological data, facility layout and dimensions and emission data. We purchased meteorological data (MM5 file) from the company that distributes the CALPUFF model (http://www.src.com/calpuff/calpuff1.htm) and used it as input for the CALMET meteorological model. Each MM5 file covers a 120 km × 120 km area and contains a 10 × 10 grid with a spatial resolution of 12 km × 12 km. Our study area (Contentnea Creek Watershed and areas within five miles) is covered by one MM5 file. This grid contains hourly information for an entire year, including wind speed and direction, temperature, relative humidity, pressure, mixing ratios of water vapors, precipitation amount, solar radiation, snow cover, 2-m temperature and specific humidity, 10-m wind speed and direction and sea surface temperature. Only one MM5 file was available for our area of interest and time period, for 2006, so we used it to model ammonia emissions from CAFOs. To check whether 2006 data are representative of weather conditions in the area, we obtained weather observation data for three meteorological stations for 2000–2010: Goldsboro (latitude: 35.37935; longitude: −78.0448), Greenville (latitude: 35.6352389; longitude: −77.3853194) and Rocky Mount (latitude: 35.89295; longitude: −77.67996). Data included monthly average daily temperature, average wind direction, average wind speed and total monthly precipitation. We compared monthly 2006 data with averages for the other

9 years for each station separately (2000–2005; 2006–2010). Our comparisons showed that there was little difference between each month in 2006 and the corresponding values for the other 9 years for this month. For example, wind direction for Greenville was west (265°) in March 2006, and in six out of nine years it had a similar direction (ranging from 219° to 285°). Table 2 shows that there was little difference in wind speed between 2006 and the average for the other 9 years.

Using MM5 data, CALMET calculates 3D wind fields as 1 km × 1 km grids that are used as input for the CALPUFF model.

Table 2. Wind speed (km/hour) averaged for 2000–2005; 2007–2010 and its difference with 2006 wind speed for three meteorological stations in North Carolina [34].

Month	Goldsboro			Greenville			Rocky Mount		
	Average	2006	Difference	Average	2006	Difference	Average	2006	Difference
January	5.72	5.31	0.41	3.60	4.35	−0.74	3.92	4.35	−0.42
February	6.37	4.67	1.70	4.20	4.51	−0.30	4.18	4.51	−0.32
March	3.36	4.67	−1.31	2.37	3.54	−1.17	1.97	3.54	−1.57
April	4.05	2.57	1.47	3.38	2.09	1.29	2.96	2.25	0.70
May	3.04	4.02	−0.99	3.02	2.90	0.13	2.92	3.54	−0.62
June	3.04	1.93	1.11	3.54	3.38	0.16	2.72	2.41	0.30
July	3.54	4.02	−0.48	3.38	4.35	−0.97	3.08	3.70	−0.62
August	2.45	1.45	1.01	2.50	1.29	1.22	2.04	1.77	0.27
September	4.87	1.29	3.58	3.38	0.16	3.22	3.50	0.64	2.86
October	3.32	3.22	0.10	1.97	1.77	0.20	1.95	2.09	−0.14
November	3.72	2.90	0.82	2.25	2.09	0.16	2.29	2.09	0.20
December	4.18	1.45	2.74	2.75	1.93	0.82	3.17	1.77	1.39

CAFOs emissions were modeled as area emissions (*vs.* point or line), because hog houses and lagoons are more accurately represented as areas. We used the following procedure to calculate the dimensions of each operation. First, we randomly selected ten CAFO operations in the area and used Google Earth to draw their boundaries. Then, we calculated the total area of each CAFO (hog houses and lagoons together) and explored the relationship between the total area and the corresponding total weight of animals at each sampled operation. Our calculations showed that, on average, one kg of hog weight takes up about 0.1 m^2 of CAFO area. Using this conversion factor, we calculated the areal extent of each CAFO operation, representing it as a square of a certain size. Each square was centered on the latitude/longitude coordinates of the corresponding CAFO. Each CAFO's area size information, along with its elevation above sea level, was put into the CALPUFF model.

Finally, to calculate ammonia emissions from each CAFO, we used ammonia emission rates reported in the literature. A study by Aneja *et al.* [35] reported that emissions from barns ranged from 0.89 to 1.05 kg-N/week/1000 kg × lm for the cold and warm season, respectively (lm = live animal mass). When recalculated in different units (g/year), these emissions amount to 46.28–54.6 g-N/year/kg live mass. This study also reported ammonia flux rates per minute per square meter of waste lagoon surface. Since we did not have information about the size of each waste lagoon, we could not use the rates reported by this study and instead applied emission rates that were calculated per year per live animal weight or per animal, as reported in a study by Doorn *et al.* [36]. This study, conducted by the EPA, recommended a

general emission factor for hog houses of 59 ± 10 g NH_3/kg live weight/year and for swine lagoons, of 2.4 kg NH_3/year/hog. We multiplied these rates by the corresponding numbers from the CAFOs table (total live weight and the number of hogs at each operation, respectively) and added two emissions together to get the total emissions amount per CAFO per year. We accepted CALPUFF's default settings and did not model the removal of the ammonia (wet deposition, dry deposition) or its chemical transformation. The output from CALPUFF model was input in CALPOST to produce daily average ammonia concentrations for the entire study area. It was then imported into ArcGIS software as a raster grid with a pixel size of 1 km × 1 km. To calculate the average daily ammonia concentrations per census block, we used the zonal statistics operation in ArcGIS 10.

4.2. Assessing Disproportionate Exposure

To assess disproportionate population exposure to ammonia concentrations, we used techniques of traditional and spatial statistics. First, we calculated the correlation coefficient between ammonia concentrations and each demographic variable for 2000 and 2010. Since North Carolina imposed a CAFO moratorium in 1997–2007, we assumed that the number of CAFOs did not change between 2000 and 2010 and used CALPUFF results for both 2000 and 2010 analyses.

We utilized a Spearman's correlation coefficient in IBM SPSS Statistics [37] to measure the associations between the average NH_3 concentrations and the specific sociodemographic characteristics of each census block. Spearman's rank correlation is a nonparametric statistic that first converts the values of the variables to ranks and then calculates the correlations as follows [38]:

$$r_s = 1 - \frac{6\sum D^2}{n^3 - n} \quad (1)$$

where:

r_s = Spearman's rank correlation coefficient;

D = the differences between the rank values for each feature on the two variables;

n = the number of features.

The value of r_s in the result is constrained from 1 (a perfect direct correlation) to −1 (a perfect inverse correlation). The closer r_s is to ±1, the stronger the monotonic relationship, while a r_s near 0 indicates no relationship between the two variables [39].

In order to examine the correlation between ammonia concentrations and sociodemographic variables spatially, a bivariate local indicator of spatial association (LISA) analysis was performed using GeoDa software [40]. Developed by Luc Anselin [41], a local indicator of spatial association, also known as a univariate LISA, tests whether local correlations between values of a feature and values of its neighbors are significantly different from what would be expected from a complete spatial randomization. It identifies significant spatial clusters by involving the cross product between the standardized value of a variable for feature i and that of the average of the neighboring values:

$$I_i = \frac{x_i - \bar{X}}{S_i^2} \sum_{j=1, j\neq i}^{n} \omega_{i,j}(x_j - \bar{X}) \quad (2)$$

where:

x_i = an attribute value for feature i;

$\bar{X}$ = the mean of the corresponding attribute;
$\omega_{i,j}$ = the spatial weight between features i and j, and:

$$S_i^2 = \frac{\sum_{j=1, j\neq i}^{n}(x_j - \bar{X})^2}{n-1} - \bar{X}^2 \quad (3)$$

n = the total number of features.

As a simple extension of the univariate LISA, the bivariate LISA identifies the extent of spatial clusters by involving the cross product of the standardized values of one variable at location i with that of the average neighboring values of the other variable. The statistical significance of these spatial clusters is evaluated using Monte-Carlo spatial randomization [41].

Bivariate LISA produces four clusters: high-high, high-low, low-high and low-low. In the context of our study, a high-high cluster indicates areas with a higher than average concentration of ammonia surrounded by neighbors with more than the average number of people from a vulnerable population group (children, the elderly, whites or minorities). A high-low cluster indicates areas with a higher than average concentration of ammonia surrounded by neighbors with less than the average number of people from a vulnerable population group. A low-high cluster indicates areas with a lower than average concentration of ammonia surrounded by neighbors with more than the average number of people from a vulnerable population group, and a low-low cluster indicates areas with a lower than average concentration of ammonia surrounded by neighbors with less than the average number of people from a vulnerable population group.

To conduct the LISA analysis, a weights matrix is created to conceptualize the spatial relationships. Considering that the areal units are irregular, this study used a distance-based spatial weight matrix, selecting polygons located within a particular distance as neighbors of the target polygon. Since this particular distance is an important parameter for modeling spatial relationships, we selected an appropriate distance threshold with the assistance of the Incremental Spatial Autocorrelation tool in ArcGIS. Specifically, this tool examines spatial autocorrelation at various distances and provides the associated z-scores reflecting the intensity of spatial clustering [42]. The distance associated with the highest z-score is chosen as the threshold distance for the weight matrix. Incremental Spatial Autocorrelation identified 4 kilometers as the distance that resulted in the highest z-score, so we used it as the threshold for the calculation of the spatial weights matrices for both 2000 and 2010.

5. Results

The raster grid of modeled ammonia concentrations is shown in Figure 3. The average modeled concentration is 14.773 μg/m^3, (min = 0.549; max = 540.837 μg/m^3). The maximum value is observed in areas where multiple CAFOs are located next to each other, mostly in Green County. To validate our model, we compared our results with a study by Wilson and Serre [43], who used passive samplers to measure ammonia in eastern North Carolina. They found that, at sites within 2 km from a hog CAFO, the ammonia concentration averaged 19.872 μg/m^3, reaching as high as 115.2 μg/m^3. While these measurements are very similar to our modeled concentrations, it is important to note that we only modeled emissions from swine CAFOs and did not account for other sources of ammonia. According to Battye *et al.* [44], livestock waste accounts for about 80% of ammonia emissions in North Carolina, and other sources include fertilizer application, forests, non-agricultural vegetation and motor vehicles.

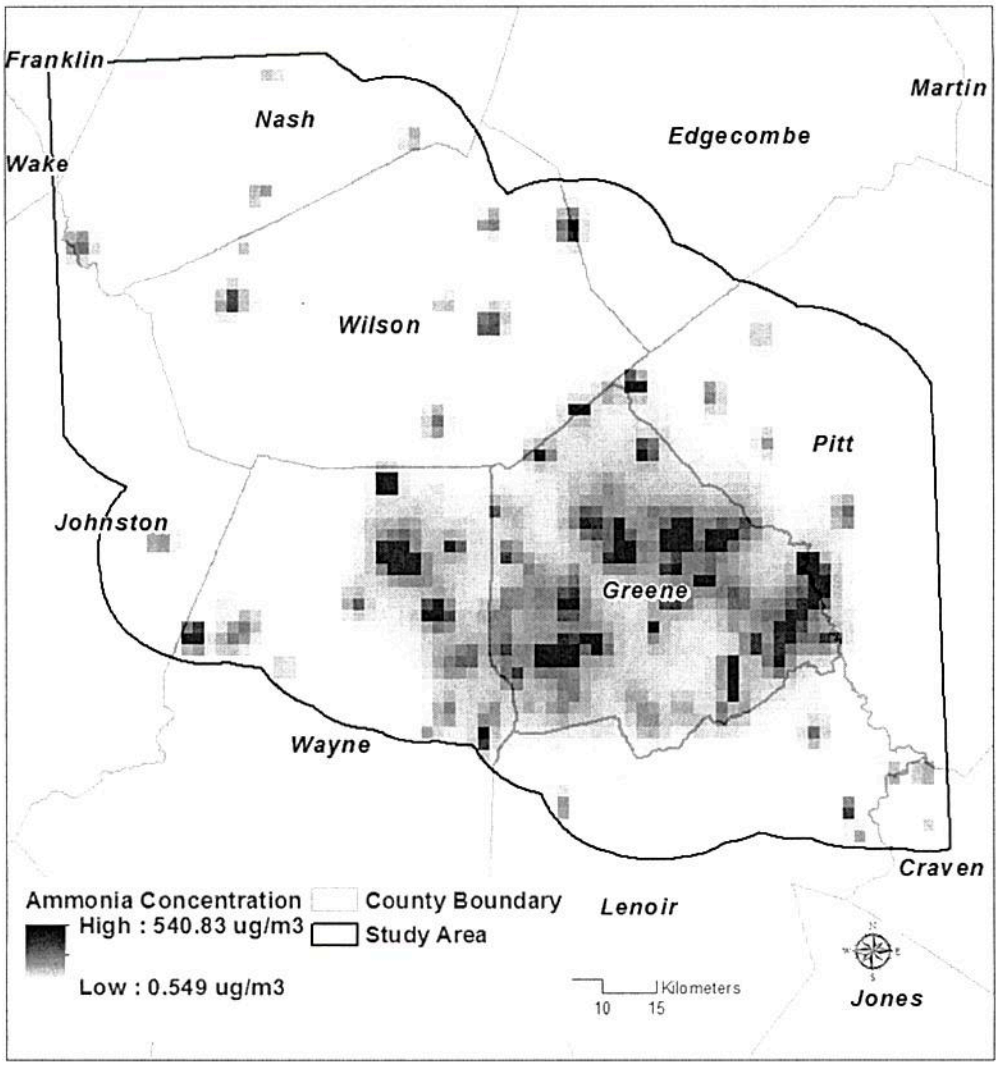

Figure 3. CALPUFF output: modeled ammonia concentrations (μg/m^3).

We also compared our results with concentrations measured at an Ambient Ammonia Monitoring Network (AMoN; http://nadp.sws.uiuc.edu/amon/) site located about 50 km outside our study area (Clinton Crops Research Station; latitude 35.0258; longitude −78.2783). This AMoN site is the closest to our study area. Based on biweekly samples from February 2009 to February 2010, ammonia concentrations at this site ranged from 1.11 to 8.3 μg/m^3, with a mean concentration of 4.191 μg/m^3. These measurements are comparable to our modeled concentrations (mean values of 4.191 *vs.* 14.773 μg/m^3, respectively). Lower values at the monitoring station could be explained by the fact that it is located 1.4 km from the nearest CAFO, while our model predicts concentrations for the entire study area, including areas in the immediate vicinity of CAFOs.

The Spearman's correlation between the average ammonia concentrations and each demographic variable for 2000 and 2010 is shown in Table 3. In 2000, statistically significant, but weak, relationships were identified between the average ammonia concentration and three demographic variables. Specifically, population under 15 years of age and minority population have a significant positive correlation with the ammonia concentration at the 99% confidence level; population over 65 years of age and the ammonia concentration are significantly correlated at the 95% confidence level. However, in 2010 only, minority

population had a significant, but weak, positive correlation with the average concentration of ammonia. No significant relationship was found for the other three variables.

Table 3. Spearman's rank correlation coefficients (* $p < 0.05$; ** $p < 0.01$).

Year	*Demographic Variable*	*Ammonia Concentration*
2000 Census Data	*Under 15 years of age*	0.046 **
	Over 65 years of age	0.038 *
	Minority population	0.162 **
	White population	−0.034
2010 Census Data	*Under 15 years of age*	0.024
	Over 65 years of age	0.008
	Minority population	0.104 **
	White population	−0.031

Bivariate LISA examined the correlation between the ammonia exposure and demographics and identified significant spatial clusters ($p = 0.05$). For the purposes of this study, we focus our attention on high-high clusters, because they represent areas where high numbers of vulnerable people are exposed to higher than the average level of pollutant concentrations. These high-high clusters are also often referred to as "hot spots". We calculated the average ammonia concentrations in hot spots for 2000 and 2010 and compared them with ammonia concentrations for the whole study area (Table 4). Our calculations show that average ammonia concentrations in hot spots for 2000 and 2010 are 2.5–3-times higher than the average concentration in the entire watershed. Figures 4–7 show the locations of high-high clusters for both years for four vulnerable population groups.

Table 4. Statistics for ammonia concentrations ($\mu g/m^3$) in the entire study area and in the 2000 and 2010 hot spots for minorities, whites, children (under 15 years old) and the elderly (over 65 years old).

Statistics	Entire Study Area	2000 Hot Spots				2010 Hot Spots			
		Non-White	White	Under 15	Over 65	Non-White	White	Under 15	Over 65
Min	0	14	4	14	14	14	6	14	0
Max	530	316	530	530	138	87	530	530	530
Mean	12	37	34	33	30	34	32	32	31

In both years, high-high clusters indicating a high ammonia concentration and a high population under 15 years of age are mainly located in Wayne County, close to the boundary of Greene County. Several small clusters can also be found in Greene, Lenoir and Pitt counties. In 2000, 148 census blocks were included in high-high clusters; in 2010, that number increased to 160. This change is also reflected in the number of children who lived in these hot spots: it increased by 15 children.

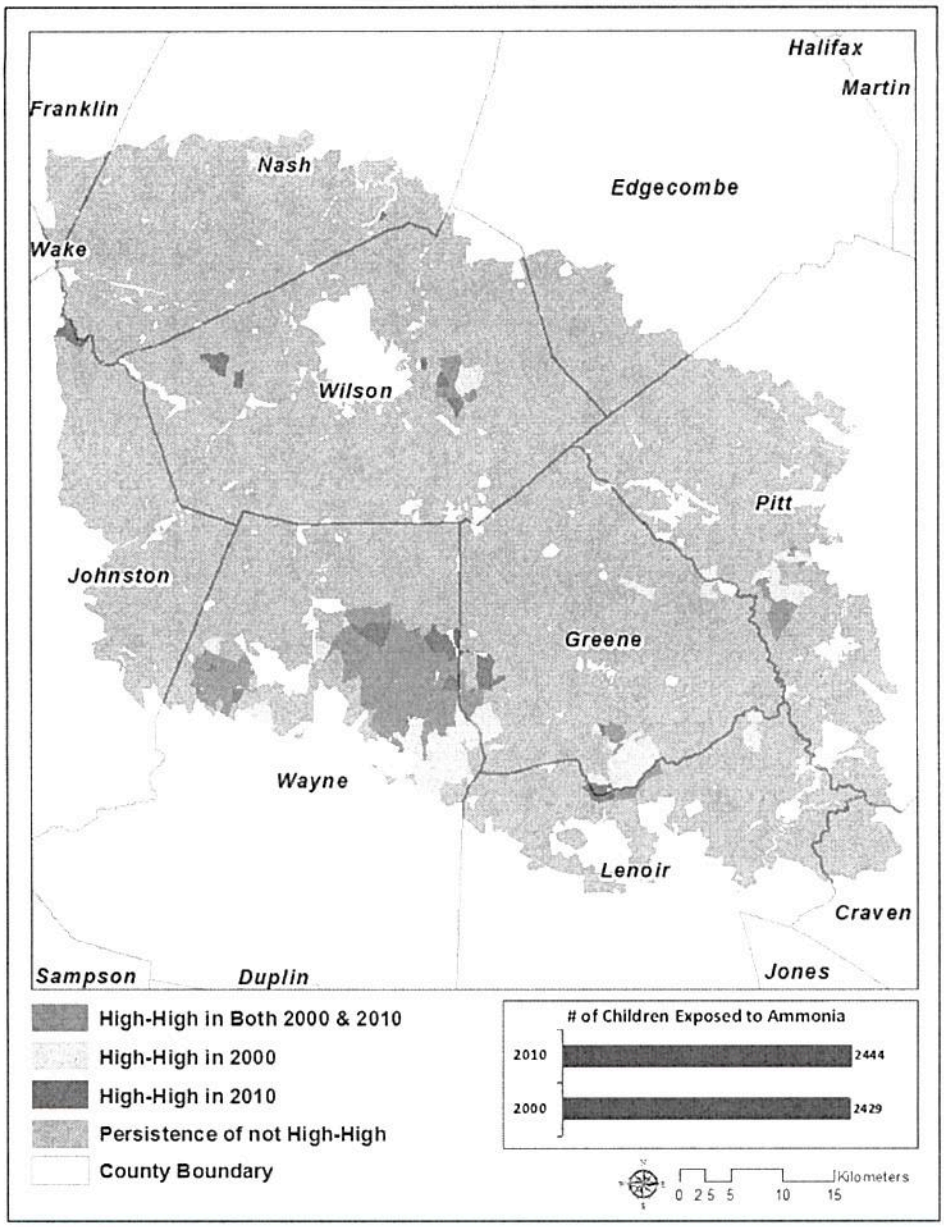

Figure 4. Bivariate local indicator of spatial association (LISA) hot spots in 2000 and 2010: average ammonia concentration with population under 15.

When analyzing the spatial association between ammonia concentration and population over 65 years of age, large high-high clusters for both years can be found in Wayne and Greene counties. In 2000, 190 census blocks were included in high-high clusters; in 2010, that number was 189. The number of elderly living in hot spots decreased by 73 people between 2000 and 2010.

A different pattern is observed for minority population, and most of the high-high areas showing persistence in both years are located in Greene County. Wayne and Wilson Counties also contain a small number of high-high clusters in both years. In 2000, 188 census blocks were included in high-high clusters; in 2010, that number decreased to 124. One hundred fewer minority people were living in these hot spots in 2010 as compared to 2000.

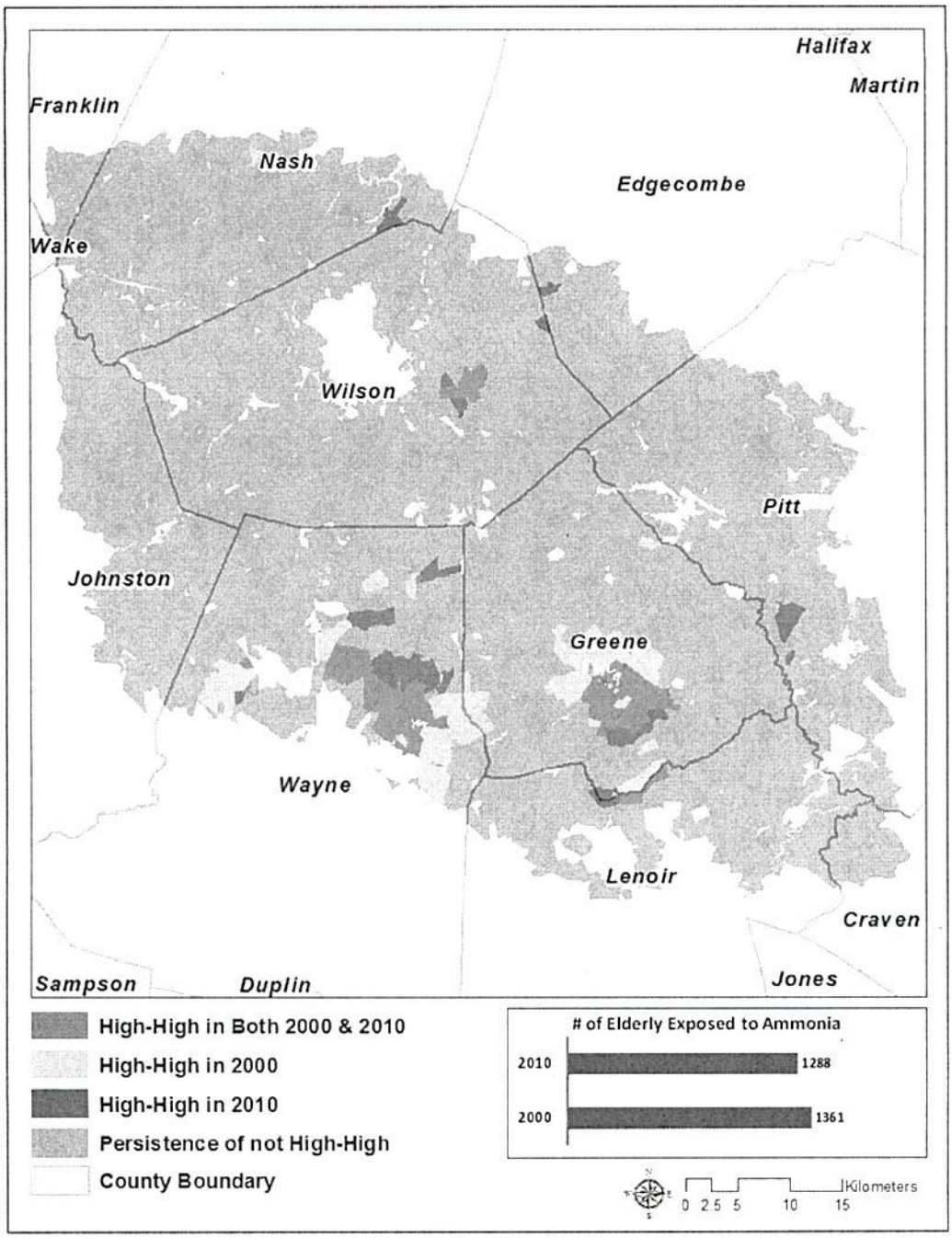

Figure 5. Bivariate LISA hot spots in 2000 and 2010: average ammonia concentration with population over 65.

In both years, high-high clusters indicating a high ammonia concentration and high white population are mainly located in Wayne and Pitt Counties. In 2000, 132 census blocks were included in high-high clusters; in 2010, that number increased to 182. The number of white people who lived in these hot spots increased by 934.

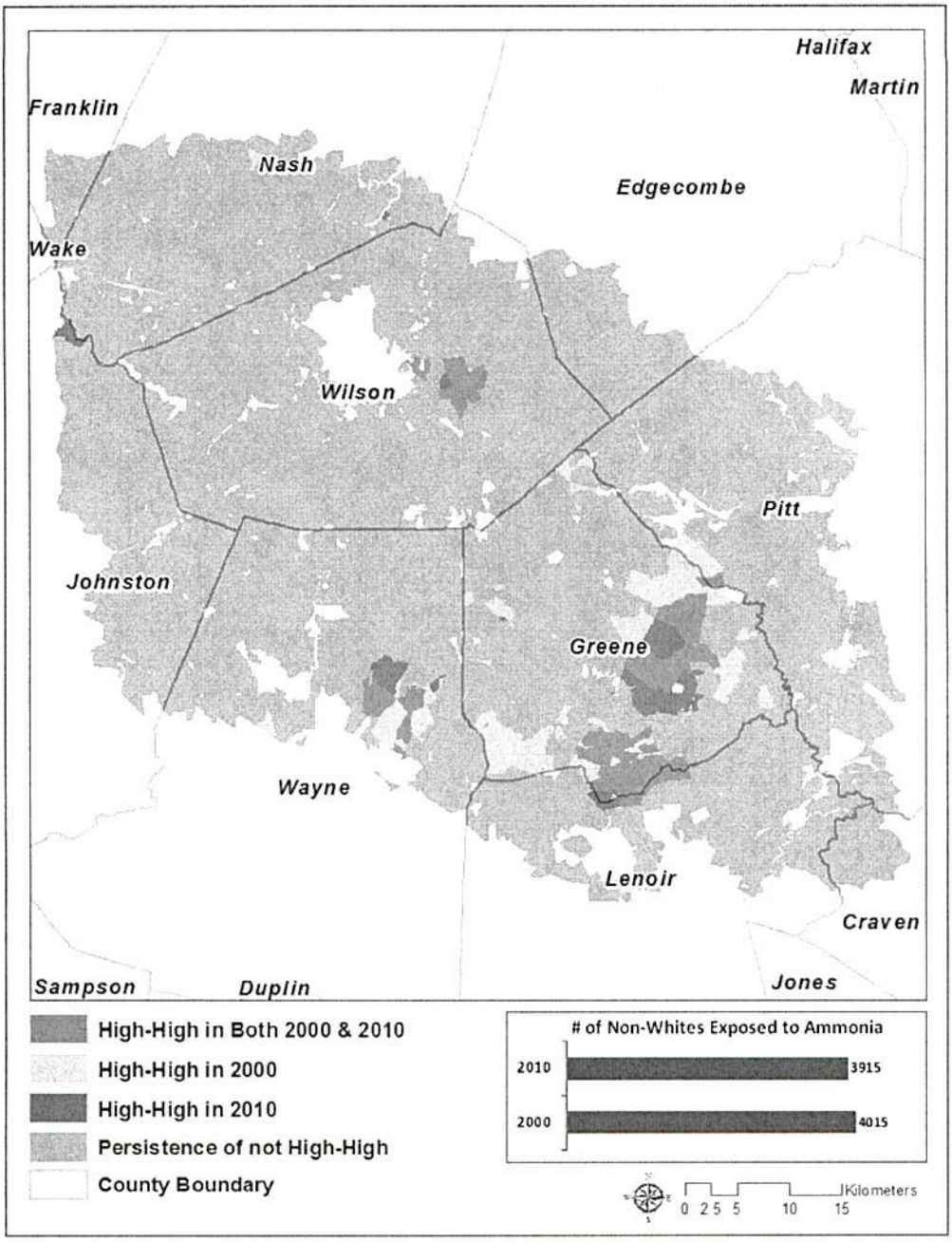

Figure 6. Bivariate LISA hot spots in 2000 and 2010: average ammonia concentration *vs.* population of minorities.

To compare the spatial locations of persisting hot spots of four vulnerable populations, we overlaid four maps. Spatial coincidence analysis showed 12 census blocks that belonged to a persisting hot spot in all four maps (Figure 7). These areas are located in Wayne County and represent an extreme case of potential environmental injustice, where disproportionately high numbers of children, elderly, whites and minorities could have been exposed to high ammonia concentrations in 2000 and 2010.

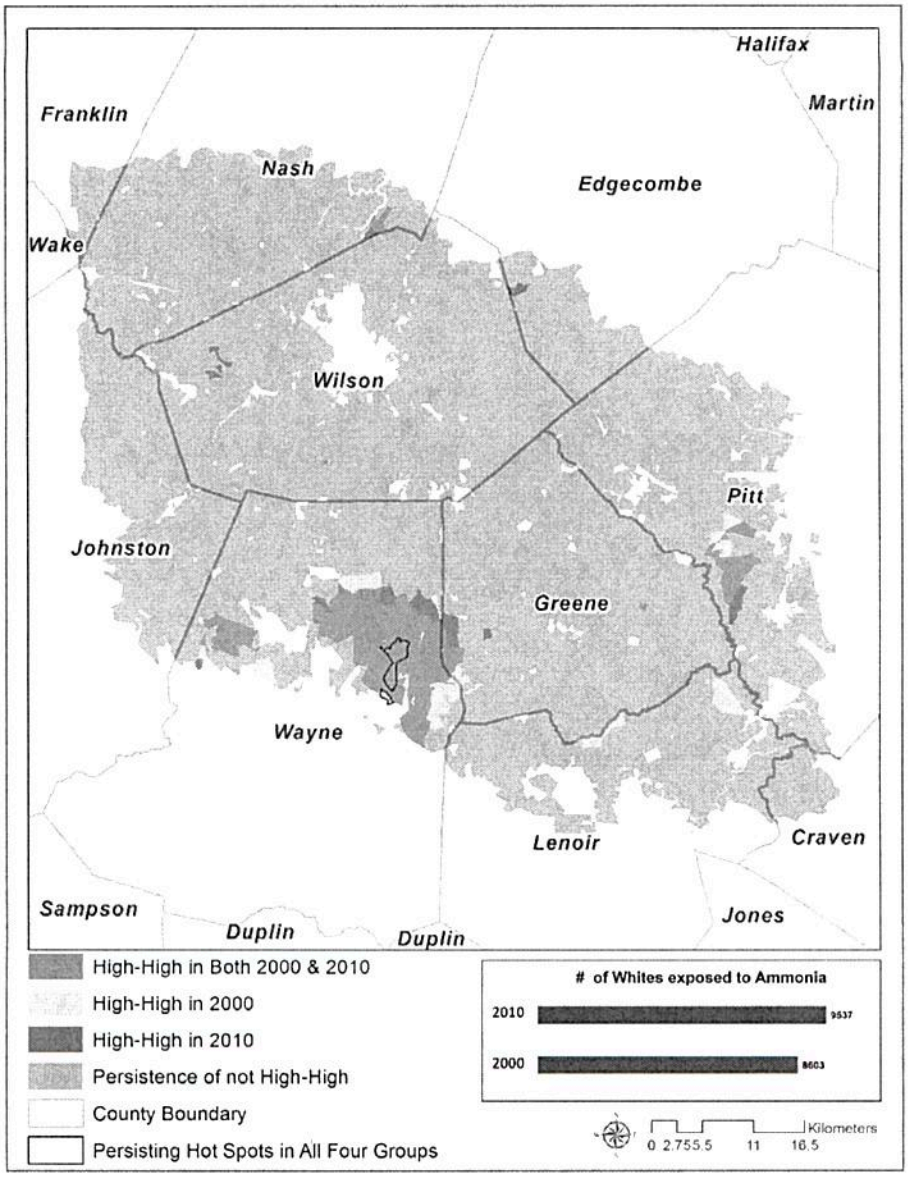

Figure 7. Bivariate LISA hot spots in 2000 and 2010: average ammonia concentration *vs.* population of whites and persisting hot spots of all four population groups.

6. Discussion and Conclusions

The main research question of this study asked if children, the elderly, white and minority populations are disproportionately exposed to ammonia emitted by CAFOs in Contentnea Creek Watershed in North Carolina. To answer this question, the study used the CALPUFF software to model ammonia emission and dispersion from CAFOs and applied the Spearman correlation and LISA analysis to examine the relationship between ammonia concentrations and demographic characteristics in 2000 and 2010.

The CALPUFF model used very detailed data about meteorological conditions and the characteristics of CAFO facilities (location, dimensions and ammonia emissions per hog or kg of live weight) to produce ammonia emission estimates as a continuous surface with 1-km^2 pixels. The fine spatial scale of the modeled ammonia output matched the spatial dimensions of census data very well: the average census block in the study areas is 0.78 km^2. Areas with the highest concentration of ammonia were found in Greene County and Wayne County, where the concentration of CAFOs is the highest.

The Spearman's correlation analysis showed that a weak positive relationship existed between average ammonia concentration and some of the demographic variables. Most of the correlation coefficients were statistically significant, probably due to the large sample size (the number of census blocks in each year was over 3000). While these findings indicate that higher numbers of vulnerable people are associated with higher ammonia concentrations in the area, they do not provide any insight into the spatial pattern of these relationships.

Bivariate LISA analysis identified hot spots of environmental injustice: areas with high ammonia concentrations are surrounded by areas with high numbers of vulnerable population. Although the population in three vulnerable groups within hot spots has slightly decreased between the two years, the number of people disproportionately exposed to ammonia concentrations was still large in 2010: 2444 children, 1288 elderly people, 9537 whites and 3915 minorities.

Using spatial overlay in GIS, we identified areas that could have experienced an extreme case of environmental injustice, because they were included in hot spots for all four population groups in both years. A spatial query showed that just within three miles from these areas, there were 12 CAFOs. The results of air pollution modeling suggest that these areas should be prioritized for ambient air quality monitoring.

It is beneficial to discuss these findings in the context of existing air quality regulations. Unfortunately, there is no federal-level standard regarding ammonia, because it is not one of the six criteria air pollutants covered by the Clean Air Act (http://scorecard.goodguide.com/env-releases/def/cap_naaqs.html). EPA requires some CAFOs to report estimated ammonia and hydrogen sulfide emissions based on the number of confined animals. For example, swine CAFOs that have more than 2500 swine, each weighing 55 pounds or more, or 10000 swine, each weighing less than 55 pounds, are required to report their emission estimates (http://www.ecy.wa.gov/epcra/CERCLA_CAFOairexempt.pdf). The Occupational Safety and Health Administration (OSHA) has set an acceptable eight-hour exposure and a short-term (15 min) exposure level for ammonia (http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=10&tid=2), but these standards mainly concern CAFO workers and are not directly applicable to the general population living in the area. State-level air quality regulations vary, and the majority of states do not have a comprehensive air quality regulatory system. For example, Missouri has an ambient acceptable level of ammonia, and North Carolina and Colorado have regulations concerning odor emissions from CAFOs, but no emission standards for hydrogen sulfide or ammonia [45].

The Agency for Toxic Substances and Disease Registry (ATSDR) includes ammonia in its toxic substances list and provides minimal risk level concentrations for it. According to the ATSDR, the minimal risk level (MRL) "is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse, non-cancer health effects over a specified duration of exposure. The information in this MRL serves as a screening tool to help public health professionals decide where to look more closely to evaluate possible risk of adverse health effects from human exposure." (http://www.atsdr.cdc.gov/mrls/index.asp). Ammonia's MRL for chronic exposure (meaning exposure for one year or longer) is set at 0.1 ppm, or 75 $\mu g/m^3$ (http://www.atsdr.cdc.gov /mrls/mrllist.asp#2tag). Applying this threshold to our modeled concentrations, we identified areas where chronic exposure exceeds MRL. Most of these areas overlap with our identified hot spots and correspond to high CAFO density areas in Greene and Wayne Counties. While the spatial extent of these areas is small (2.5% of the watershed), they correspond to densely populated areas with total population

ranging from 3647 people in 2000 to 3360 people in 2010. Following ATSDR's suggestion, these areas deserve further attention of public health professionals to examine possible adverse health effects due to chronic exposure to higher than the minimal risk levels of ammonia.

This study contributes to the body of research on CAFOs and environmental justice, because no other study has yet analyzed environmental justice on the basis of unequal exposure to CAFO-related emissions. Previous environmental justice studies of CAFOs used proximity to CAFOs or their density as the proxy for air pollution exposure. Our study is the first one to directly link modeled pollutant concentrations and demographic characteristics. The proposed methodology is also the first one of its kind to analyze CAFOs-related environmental justice at the finest possible spatial scale, the census block. Previous studies conducted their analysis at the county, census track or census block group levels.

Our study also contributes to a broader literature on environmental justice. Traditionally, environmental justice research has analyzed unequal exposure in the context of race and poverty; including age-based vulnerable population groups in the analysis is an advantage of our study. Both children and elderly are recognized as the most vulnerable age groups, but they are rarely included in environmental justice studies.

There are several limitations to this study, mostly associated with the CALPUFF model and data availability. First, to run the CALPUFF model, we needed very detailed meteorological data, and the only available data compatible with CALPUFF was for 2006. Therefore, we assumed that the 2006 meteorological data represents the average meteorological situation and used CALPUFF output based on 2006 to analyze environmental justice in 2000 and 2010. Since the entire year of data was used to model average daily ammonia concentrations, this assumption seems reasonable. The second limitation relates to CALPUFF model parameters (for example, the user's choice for background pollution concentrations, the incorporation of wet and dry deposition or the choice of chemical conversion mechanism). We accepted the default settings within the model, and future studies should assess the sensitivity of modeling results to these parameter settings. The third limitation is related to CAFO data availability, including the type and individual size of manure storage facilities. We used 2010 CAFO data to analyze unequal exposure in 2000 and 2010, assuming that the CAFO size did not change during this time to an extent that it would have an effect on the modeled ammonia concentrations. We also did not have data on the type of facility (breeder *versus* finisher facility) nor the management practices and assumed that the emissions rate is the same for all facilities and remains constant thought the year.

Another limitation of this study is that our findings are only valid at the census block level and cannot be extrapolated to other spatial scales. The reason for that is that the relationships between hazardous facilities and socioeconomic variables may change or become more or less significant when the spatial scale changes [46]. This issue is often referred to as the modifiable area unit problem [47].

Our modeled ammonia concentration was comparable to ammonia concentrations measured in the field by other researchers [43] and by the Ambient Ammonia Monitoring Network. In the future, it would be important to test other atmospheric dispersion models and to compare their results with CALPUFF and field measurement for various pollutants and different geographical regions. These studies should include up-to-date characteristics of polluting facilities, such as individual CAFO operations (e.g., exact size of animal houses and lagoons, number of animals, total animal weight). More studies of this kind (based on pollution dispersion models and using reliable fine-scale demographic data) will allow one to

assess the impacts of the CAFOs and to address the concerns regarding the health and quality of life of vulnerable populations.

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Author Contributions

Yelena Ogneva-Himmelberger conceived of and designed the study and drafted the manuscript. Liyao Huang performed census data collection and analyses, contributed to some sections of the manuscript and created maps. Hao Xin collected CAFO data and ran CALPUFF to model ammonia concentrations.

Conflicts of Interest

The authors declare no conflict of interest.

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The State

EPA to probe whether N.C. hog farms violate neighbors' rights

By BRUCE HENDERSON

The Charlotte ObserverFebruary 26, 2015

The Environmental Protection Agency has agreed to investigate claims that North Carolina's regulation of hog farms violates the civil rights of their minority neighbors.

Three advocacy groups filed a complaint with EPA in September. North Carolina's 2,100 farms produce about 10 million hogs a year, second-highest in the nation.

The groups claim the Department of Environment and Natural Resources' lax regulation of the farms discriminates against the African Americans, Latinos and Native Americans who live near the farms in disproportionate numbers.

Advocates filed the complaint after North Carolina renewed a statewide permit regulating hog farms last year without substantially stiffening standards, the groups say.

The complaint was filed under a section of the Civil Rights Act of 1964 that prohibits recipients of federal aid from discriminating on racial or other grounds.

EPA agreed to investigate but said it has not determined the merits of the complaint. The agency also asked for more information about one part of the complaint, on DENR's enforcement of swine regulations, before agreeing to investigate it.

EPA often tries to resolve such complaints informally. Previous settlements have involved changes in policies and practices, not fines.

"I do hope that with the investigation, EPA will talk to people in the impacted communities. It would be good for EPA to listen to the voices that live this struggle," said Devon Hall of the Rural Empowerment Association for Community Help in Duplin County, North Carolina's biggest hog producer.

DENR spokesman Drew Elliot said "We understand that the EPA has agreed to review the complaint and will provide any information the agency needs during that process."

The civil rights complaint is part of a growing number of challenges of North Carolina's $2.5 billion hog industry.

Neighbors have filed 25 federal lawsuits claiming North Carolina farms under contract with hog producer Murphy-Brown LLC are nuisances. The lawsuits have not come to trial.

Eight advocacy groups sued the Environmental Protection Agency in January to try to force federal action on air pollution from industrial livestock farms.

Industrial-scale hog farms in Eastern North Carolina generate massive amounts of manure that is washed into open pits called lagoons. Nutrient-rich effluent from the lagoons is then sprayed on farm fields as fertilizer.

The result, neighbors say, is a choking stench. Studies have shown that people who live near farms often suffer burning eyes, breathing problems, headaches, anxiety, blood pressure spikes.

A study published in January by UNC Chapel Hill and Johns Hopkins University researchers found heavy bacteria from swine in some streams near farms.

The statewide permit North Carolina renewed last year continued the discrimination, said Marianne Engelman Lado, an Earthjustice attorney representing North Carolina's Rural Empowerment Association for Community Health, the North Carolina Environmental Justice Network and the Waterkeeper Alliance.

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Environmental Justice

EPA Civil Rights Unit to Investigate Claims That N.C. Hog Farm Permit Harms Minorities

By Jeff Day

Feb. 25 — The Environmental Protection Agency's civil rights unit said it will investigate allegations made by three North Carolina groups that the state government's general environmental permit for hog farming and hog farm waste is causing disproportionate harm to people of color.

The North Carolina Environmental Justice Network, the Rural Empowerment Association for Community Help and the Waterkeeper Alliance, represented by Earthjustice, had asked the EPA to examine the impact of the North Carolina Department of Environmental and Natural Resource's 2014 renewal of a general permit for industrial swine operations (172 DEN A-18, 9/5/14).

Earthjustice announced Feb. 25 that the EPA Office of Civil Rights accepted the request.

The permit "allows industrial swine facilities in North Carolina to operate with grossly inadequate and outdated systems of controlling animal waste and little provision for government oversight, with a disproportionate impact on the basis of race and national origin,"the groups said in their petition to the EPA.

The groups said the permit violates Title VI of the Civil Rights Act of 1964 and associated EPA regulations.

Drew Eliot, spokesman for the Department of Environmental and Natural Resources, told Bloomberg BNA Feb. 25 that DENR is aware that the EPA's Office of Civil Rights will investigate the claims. He said DENR will provide any information needed for the probe.

Office of Civil Rights Director Velveta Golightly-Howell said Feb. 20, in responding to EarthJustice's petition, that OCR will investigate the allegation that the DENR general permit violated the Civil Rights Act and related EPA regulations.

However, Golightly-Howell said the office didn't have sufficient evidence to investigate a second claim: that DENR's enforcement of the permit violated the act. She gave Earthjustice 20 days to supply evidence.

To contact the reporter on this story: Jeff Day in Washington at jday@bna.com

To contact the editor responsible for this story: Larry Pearl at lpearl@bna.com

For More Information

View the letter from the EPA Office of Civil Rights to Earthjustice at http://earthjustice.org/sites/default/files/files/EPA%20Notice%20of%20Acceptance.pdf.

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EPA to probe whether NC environment agency failed minorities

Posted 8:37 p.m. yesterday
Updated 8:39 p.m. yesterday

By EMERY P. DALESIO, Associated Press

RALEIGH, N.C. — The U.S. Environmental Protection Agency has decided to investigate whether lenient regulation by North Carolina's environmental agency of industrial hog operations harmed minority neighbors.

The Waterkeeper Alliance and other groups released an EPA letter Wednesday stating that the federal agency will launch a civil rights investigation of North Carolina's Department of Environment and Natural Resources. The groups had asked the EPA last fall to investigate whether state officials would have been tougher on 2,000 North Carolina swine operations raising 10 million hogs if the neighbors were not black, Hispanic or Native American.

"What they're looking at is whether or not living in proximity to the facilities is harmful and whether or not that harm disproportionately impacts" minorities, said Marianne Engelman Lado, an attorney for the advocacy group Earthjustice, representing the complaining groups. "The community has for generations at this point, for decades, been crying for more protection from the waste."

The EPA letter dated last Friday said its decision to investigate doesn't suggest it has found evidence backing the complaint.

"We understand that the EPA has agreed to review the complaint and will provide any information the agency needs during that process," DENR spokesman Drew Elliot said in an emailed statement.

EPA said in a statement that its Office of Civil Rights is trying to resolve the complaint informally while it investigates the state agency.

Neighbors of industrial-scale hog farms have complained for decades that collecting manure in cesspools before spraying them onto farm fields generates unbearable smells and harms health.

EPA said it needs more information before it decides whether to investigate a second allegation — whether North Carolina's DENR failed to enforce its regulatory or statutory requirements for swine farms.

The EPA complaint is part of a raft of efforts by environmentalists, community groups, and local governments from Washington state to Iowa and North Carolina pressuring the livestock industry to change its methods. The arguments are based on studies that increasingly show the impact phosphorous, nitrate and bacteria from fertilizer and accumulated manure have on lakes and rivers and find that air pollution related to livestock operations may be harmful to respiratory health.

The activism comes decades after hog and other livestock operators joined other types of farm producers in consolidating. For example, the hog industry had more than 200,000 farms in the early 1990s, a number that fell to about 21,600 by 2012.

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